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ABSTRACT

The cost of a bachelor's degree was estimated and compared for different types of institutions. The objective was to develop a single index to show how much each type of institution spends on producing a bachelor's degree graduate, and to use trend data to show how these costs will change over time. The basic concept associated with the cost of a bachelor's degree and the technical problems involved in the estimation are discussed. Of concern are direct costs, which include only instruction expenditures, and full costs, which include both direct costs and allocated costs. To determine how the major characteristics of colleges affect the costs of bachelor's degrees, schools are classified according to their full costs of bachelor's degree: the low-cost group is the lowest 25% of these ranked institutions, while the highest 25% is the high-cost group, and the ones in between (25-75%) are the medium-cost group. Main factors in cost determination include: the composition of students (e.g., part-timers, graduate students); class size; affluence and prestige; and school size. A sensitivity analysis and methodology modifications are included. Appended are rebuttal comments on the cost issue and the analysis by Paul T. Brinkman and Dennis P. Jones, Alan P. Wagner, and Robert Zemsky and an afterword by Chester E. Finn, Jr. (SW)

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Estimating the Cost of a Bachelor's Degree:

An Institutional Cost Analysis

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Estimating the Cost of a Bachelor's Degree:

An Institutional Cost Analysis

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September 1987

Foreword

"What should American colleges and universities spend to educate students?" So asked Howard Bowen, in his well-received study, The Costs of Higher Education in 1980. "It is a question...(he writes)... faced by governing boards and administrative leaders for their particular institutions, it is confronted by public officials and donors as they ponder appropriations for higher education, and it is even considered by students and their families as they decide what college to attend."

The issue is becoming critical as higher education expenditures continue to rise in this decade. As shown by results of the Higher Education General Information Survey (HEGIS), higher education expenditures have increased 18 percent, from $76 billion in 1975-76 to $90 billion in 1984-85 (in 1984-85 constant dollars), while student enrollment in the same period has increased 9 percent, from 11.2 million to 12.2 million. The majority of revenues to support higher education have come from the local, State, and Federal governments. The private sector has also recognized the importance of education by making significant contributions to colleges and universities. In 1985 alone, private sources such as corporations and foundations contributed more than $5 billion.

Policymakers in all sectors have been concerned about the results they receive from these expenditures. Despite the funding increases, many recent reports have criticized the effectiveness of higher education. These reports indicate disturbing trends such as lower academic standards and poor academic skills of graduates. Policymakers as well as the general public have begun to ask many difficult questions. Some of them concern college student achievement -- e.g., what have graduates learned in college, and why has student performance declined in 11 of 15 major subject area tests of the Graduate Record Examinations between 1964 and 1982? Other questions relate to the cost of higher education. Washington policymakers for example, want to know what they are getting for Federal dollars, and how effectively and efficiently the money is being spent.

In the Higher Education Amendments of 1986, Congress mandated a study to determine 1) why costs of higher education have changed so rapidly in recent years, 2) the specific causes of such changes, and 3) the future cost of obtaining a higher education. State-level policymakers are also concerned with the rising cost of higher education. In a recent National Governors' Association report, Time for Results, John Ashcroft, Governor of Missouri, said, "The public has the right to know what it is getting for its expenditure of tax resources; the public has a right to know and understand the quality of undergraduate education that young people receive from publicly funded colleges and universities. They have a right to know that their resources are being wisely invested and committed."

Many educational researchers and analysts have already begun to search for creditable data and methodologies to address these issues. For example, the National Science Foundation is sponsoring a study to examine the cost of an engineering degree, and the Bureau of Health

Professions in the Department of Health and Human Services has done an analysis to estimate the cost of a nursing program. At the Office of Educational Research and Improvement (OERI) in the U.S. Department of Education, various studies are also being planned.

One early, exploratory effort to analyze college costs has been undertaken by Duc-Le To of OERI. As noted in Dr. To's report, cost issues are complex. They can be examined from the student or societal viewpoint as well as from an institutional perspective. Each approach, however, requires different types of data and answers somewhat different but related questions. His analysis focuses only on the cost of a bachelor's degree from the institutional perspective. The intent is to develop a simple index to show how much each type of institution spends on producing a bachelor's degree graduate and, when trend data become available, to show how these costs change over time.

In the process of conducting the analysis, it became clear that currently available data are quite limited -- there are problems with the measure of direct expenditures and the allocation of indirect costs for undergraduate instruction. The analysis is further complicated by the diversity of student enrollment patterns and institutions. Thus, a number of assumptions about direct cost measures, allocation of indirect cost, and the grouping of institutions need to be made for the analysis. Many of these assumptions remain debatable. Nevertheless, the strategies of the analysis and the results presented in the report provide an informed basis for discussion.

Four readers with different points of view were invited to provide written comments on the cost issue and Dr. To's analysis. Their comments are included in this report. These readers raised many thought-provoking questions, ranging from the clarity of definitions and purposes of the analysis, through the appropriateness of cost calculation assumptions, to the potential misuse of an "incomplete" cost measure. The reviewers are particularly concerned with the appropriateness of including student financial aid as a cost of undergraduate instruction and the failure to include some costs that are not controlled by the institution. As one of the readers, Robert Zemsky, argued, the result "seriously distorts the cost differential between public and private institutions by including financial aid expense as a cost of instruction and by failing to account for those public facilities used by public institutions but not included..." in the analysis. These readers also provide some suggestions for future studies of the cost of higher education and some solutions for the problems they identified.

A reading of the paper and the comments of the reviewers confirms the complexity of the problem. There are not only differences of opinion as to how to proceed, but also questions about the validity and wisdom of such a study, given the diverse nature of higher education. Thus, this working paper and the comments of the readers should be thought of as a starting point, rather than a definitive statement, on how much institutions should spend on educating a student or whether such amounts should be spent. Collectively, they provide the reader with a basic set of issues that needs to be considered in developing a meaningful measure of the cost of a bachelor's degree. They address the questions of data availability and adjustment factors, and how such measurements may be evaluated. This work, together with the comments that we encourage readers to send us, will be invaluable in developing designs for future studies. Furthermore, we hope that the report will stimulate discussions on how to collect valid cost data and will generate suggestions for solutions to the problem of calculating the costs of higher education as well.

Sally B. Kilgore Director, Office of Research	Emerson J. Elliott Director, Center for Education Statistics

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Duc-Le To

Contents

Foreword........iii

Sally B. Kilgore and Emerson J. Elliott

Acknowledgments........vii

Introduction........1

1. Concept and Issues........3

   Basic Concept........3
   The Problem of Joint Cost........3
   The Problem of Heterogeneous Credits........6
   The Problem of Dropouts........6

2. Methodology and Data Source........9

   Production Cost........9
   Cost of A Bachelor's Degree........13

3. Analysis of Results........15

   Major Findings........15
   Characteristics of Institutions........21
   Determinants of Cost........23
   Financing a College Degree........29
   Trends of the Costs of Bachelor's Degrees........31

4. An Assessment........33

   Sensitivity Analysis........33
   An Alternative Cost Ratio........33

5. Alternative Definitions and Adjustments........41

   Dropout Credits (Version 2)........41
   Number of Credits (Version 3)........45
   Broader Definition (Versions 4 and 5)........48

6. Concluding Remarks........49

Glossary of Acronyms........51

Notes........53

References........57

Comments..63

Paul T. Brinkman and Dennis P. Jones..................63
Alan P. Wagner..73
Robert Zemsky...81

Rejoinder...87

Afterword...91

Chester E. Finn. Jr.

Tables

1. Percentage Distribution of Faculty Time by Activity, 1953-1975.....................................4

2. Changes in Resource Allocation in Higher Education, 1870-1980...5

3. Ratio of Net Values of Equipment to Net Values of Buildings and Improvements by Control, 1929-30 to 1976-77...................................12

4. Cost Ratios per Credit Hour by Level of Instruction..14

5. Full Institutional Cost of a Bachelor's Degree by Control and by Type of Institution, 1983..............16

6. Direct Institutional Cost of a Bachelor's Degree by Control and by Type of Institution, 1983..............17

7. Selected Characteristics of Institutions by Type and by Control, 1983.................................18

8. Institutional Cost of a Bachelor's Degree and Selected Variables by Region, 1983....................20

9. Characteristics of Institutions with Low, Medium, and High Costs, 1983.................................24

10. Institutional Cost of a Bachelor's Degree by Size of Institution, 1983.................................27

11. Regressions of Cost of Bachelor's Degrees on Institutional Characteristics.........................28

12. Student's Burden and Selected Financial Ratios by Type of Institution...............................30

13. Institutional Cost of a Bachelor's Degree, 1930-1983 (1983 constant dollars)........................32

14. Effects of Changes in δ on Institutional Cost of Bachelor's Degrees..................................34

15. Regression Coefficients, Means, and Cost Ratios by Type of Institution................................36

16. Full Institutional Cost of a Bachelor's Degree by Control and Type of Institution--Alternative Cost Ratios, 1983..37

17. Direct Institutional Cost of a Bachelor's Degree by Control and Type of Institution--Alternative Cost Ratios, 1983..38

18. Institutional Cost of a Bachelor's Degree--Alternative Allocation Methods.........................39

19. Institutional Cost of Bachelor's Degree--Various Versions...42

20. Lifetime Income of Men, by Years of School Completed--United States, Selected Years, 1949-1972 (in Current Dollars)...................................43

21. Full Institutional Cost of a Bachelor's Degree by Control and by Type of Institution, Adjusted for Dropout Credits, 1983..................................46

22. Direct Institutional Cost of a Bachelor's Degree by Control and by Type of Institution, Adjusted for Dropout Credits, 1983..................................47

Appendix Table: Institutional Cost of a Bachelor's Degree and Selected Variables by State, 1983..................60

Introduction

The cost of higher education has increased substantially in recent years. The public, which provides funds for higher education, has become more cost conscious, but it has been difficult to determine the costs of a bachelor's degree. The literature on this subject is scarce because researchers are reluctant to assess the cost of an educational product, the content and quality of which is unknown.

Moreover, the public's curiosity cannot be satisfied with the simple cost computation such as "expenditure per student." These numbers, even in the greatest detail, do not portray the complete picture of the cost of a degree. Today's higher education system is complicated, and people need straightforward answers to their questions.

The purpose of this paper is to provide some rough estimates of the costs of a bachelor's degree and compare them among different types of institutions. The study focuses on the costs of baccalaureate programs from the institutional perspective, i.e., the cost to an institution for a bachelor's degree. Although some cost estimates in this paper may reflect student and societal costs, it is not the intention of this study to measure costs from the student's or societal perspective. In fact, cost measured from the viewpoint of the student is not the "cost," but rather the "price" of a bachelor's degree -- a price determined by the supply and demand of baccalaureate education.

This paper intends to answer a basic question: How many resources have been allocated to the education and welfare of the students who are working for their bachelor's degrees? This question is not simple. Given the complexity of our higher education system, the answer involves some technical problems. This paper may not solve the problems, but it provides a look into the structure and operating scheme of our higher education system, which is still more or less a "black box" to many policymakers. It is hoped that this study will also be used as a starting point for further discussion.

The six parts of the report establish the approach toward determining the cost of a bachelor's degree. Part 1 discusses the basic concept associated with the cost of a bachelor's degree and the technical problems involved in the estimation. Part 2 provides details of the method with data sources and assumptions. Part 3 is a summary of the major findings with comparisons of costs and findings regarding the causes of the cost variation. Further discussion on the definition and assumptions is presented in parts 4 and 5. A sensitivity analysis and some modifications of the method can also be found in these sections. Part 6 is a conclusion with comments and suggestions on the data.

Concept and Issues

Basic Concept

A fundamental problem involved in the estimation of the cost of a bachelor's degree is the definition of a bachelor's degree. It is difficult to define a product of which the content is not measurable. Practically, students are awarded bachelor's degrees when they have completed all the credits that are required for the bachelor's program. Therefore, credits can be regarded as the basic elements of a degree, that is, a bachelor's degree can be defined as a set of completed course credits.

This definition ignores some extracurricular skills that students learn which are not reflected in the credits that students complete. Nevertheless, with this simple definition, the cost of a bachelor's degree can be estimated in two steps: (1) by estimating the "cost per credit" and (2) by multiplying this "cost per credit" by the total number of credits required (or taken).[1] There are, however, technical difficulties involved with this process.

The Problem of Joint Cost

The first problem is that bachelor's degrees are not the only products of a postsecondary institution. The activities involved in a university are more diversified. Today, faculty members not only teach, but also engage in research and administration (see table 1). As shown in table 2, the share of instruction expenditures has declined from 58.6 percent in 1930 to 41.5 percent in 1980. Meanwhile, the proportion of graduate degrees has also increased at a rapid rate. In 1930, only 12.4 percent of the degrees conferred were post-baccalaureate degrees. In 1980, this percentage increased to 24.9 percent. These facts indicate that the academic focus of the universities has shifted from undergraduate teaching to graduate teaching and research.

Therefore, it cannot be assumed that all costs are related only to undergraduate degrees.[2] As shown in tables 1 and 2, at least three "products" are produced jointly by the universities: (1) undergraduate degrees; (2) graduate degrees; and (3) research products and public service.

To estimate the cost of a bachelor's degree, only those costs that are related to the first product should be included. Unfortunately, in most cases, these three products are jointly produced and cannot be precisely separated.[3] There is no set rule in accounting or any paradigm in economic theory that allows perfect cost allocation. Some methods have been recommended in accounting and economic literature but none of them seems appropriate in this case.

Table 1. — Percentage Distribution of Faculty Time by Activity,* 1953-1975

Period	Total	Teaching			Research	Administration and other
		Total	Undergraduate	Graduate		
1953-54	100.0	65.0	53.1	11.9	12.0	23.0
1964-65	100.0	47.0	23.0	24.0	24.0	29.0
1968-69	100.0	43.5	18.1	25.4	27.5	29.0
1975	100.0	48.0	-	-	29.0	23.0

* 1953-54: Average of eleven western and mid-western universities in University of California [1960], pp. 26-29.
1964-65: Average of 106 universities in Cartter [1966].
1968-69: UCLA's figures in Bell, et al. [1972], pp. 64-70.
1975 : Data for an eastern university in James [1978].

SOURCE: James [1978], table 1.

Table 2. — Change in Resource Allocation in Higher Education, 1870-1980

Year	Percentage distribution of degrees conferred			Percentage distribution of education and general expenditures			
	Total	Post-Baccalaurate	Baccalaurate	Total	Instruction [1]	Research and public service [2]	Other
1870	100.0	0.0	100.0	—	—	—	—
1890	100.0	7.0	93.0	—	—	—	—
1910	100.0	6.4	93.6	—	—	—	—
1930	100.0	12.4	87.6	100.0	58.6	11.4	30.0
1950	100.0	13.0	87.0	100.0	45.8	18.3	35.9
1970	100.0	22.4	77.6	100.0	48.8	16.9	34.3
1980	100.0	24.9	75.1	100.0	41.5	15.5	43.0

NOTE.- [1] Data from 1930 to 1970 are "instruction and departmental research." Data for 1970 include "other sponsored programs".

[2] Data from 1930 to 1970 are the sum of "extension and public services" and "separately organized research."

— Data not available.

SOURCE: U. S. Department of Education, NCES, Digest of Education Statistics, 1983-84, table 88 and table 126.

For example, one common procedure of allocating joint cost in accounting is to allocate cost according to the sale of or the demand for the product.[4] While this method is consistent with the beneficial principle, it does not apply to nonprofit organizations, such as colleges. Another popular method is to allocate joint cost among products in proportion to an observed variable that is regarded as an index of service provided by the facilities to the product; for example, computer cost is allocated in proportion to the utilization time.[5] This approach is popular but the choice of allocation variables is difficult in this case. For instance, the best allocation variable for the undergraduate program is, perhaps, the proportionate amount of faculty time allocated to undergraduate teaching, graduate teaching, and research. However, these data are not available from a reasonable sample size. The same difficulties can be found in other cost categories.

Even with better data, however, the allocation of joint cost is still arbitrary.[6] With this given, cost has been allocated by alternative methods, details of which are discussed in part 4.

The Problem of Heterogeneous Credits

Two assumptions are made in the estimation of the cost of a bachelor's degree. The first assumption is that credits and degrees are homogeneous. This is simply not true. It costs more to produce an engineering degree than a liberal arts degree for example, and a credit in physics with laboratory sessions is more expensive than a credit in philosophy. The estimation, however, does not distinguish these differences.

One way to solve this heterogeneity problem is to construct a "curriculum matrix" of credits that reflects the course-taking pattern of students, and multiply it by a vector of costs disaggregated by academic departments. The results are the estimates of the costs of bachelor's degrees by disciplines. This approach has been pursued by Brovender (1974), Butter (1966), Gulko (1971), Razin and Campbell (1972), and Spitz (1979). This method has not been followed in this study, however, because detailed data on credits offered by the institutions are not available. In fact, all the literature cited above deals either with theory or uses data from a particular university. No data on a national basis are available.

The Problem of Dropouts

The second assumption is related to the credits taken by those who eventually drop out from the university system. The cost estimation procedure described earlier assumed that every student who enrolls will eventually graduate. This is not the case. According to a follow-up study of the high school graduating class of 1972 (see National Institute of Education, 1984, p. 8), by 1979 one-half of the students who attended college had not graduated in the 7 years. This means that the estimates derived from a method that does not take "dropout credits" into account are underestimated.

Adjustments can easily be made if the dropout rate is known (see part 5 for actual adjustments). Whether these dropout credits should be excluded and adjustments made is discretionary. It depends on the issues addressed.[7]

Methodology and Data Source

Production Cost

At least two kinds of costs should be counted as production costs of bachelor's degrees: (1) all expenditures including capital expenditures incurred in postsecondary institutions that are related to undergraduate teaching, learning, or student services and (2) all other costs that may not be incurred by institutions but are actually paid by the students, their parents, or any third party for the purpose of attending colleges and pursuing a bachelor's degree.

The first category is usually referred to as "institutional cost." It also includes tuition, scholarships, and fellowships because these expenditures, though most of them are paid by students or authorities outside the institutions, are received and used by the institutions. The second category includes all noninstitutional costs, such as transportation, books, supplies, recreation, clothing, room, and board, that is, all related costs that students have to spend that they would not have spent were they not enrolled in college. It also includes the foregone earnings that the students could have made had they not attended college. This study concentrates on the first category, i.e., the institutional cost. However, the second cost category is also included in the estimates in part 5 to show that the estimates which include only institutional costs are underestimated.

The cost data for this paper is taken from the Higher Education General Information Surveys (HEGIS) of the Center for Education Statistics, U.S. Department of Education. HEGIS classifies the institutional expenditures by functions, which can be grouped into three categories:

1. Direct operating cost: a cost directly related to instruction or student services, including (a) instruction (INS), (b) student services (SS), and (c) scholarships and fellowships (SF).[8]

2. Indirect operating cost: a cost indirectly related to instruction or student services, including (a) academic support (AS) (including libraries (LIB)), (b) institutional support (IS), (c) operation and maintenance of plants (OM), and (d) other educational and general expenditures (OT). The sum of the above costs is referred to as the joint operating cost (JCT).

3. Irrelevant cost: a cost irrelevant to instruction and student services including (a) research (RES), (b) public service (PS), and (c) other noneducational and general expenditures, such as auxiliary enterprises and hospitals.

As noted, not all of these costs are relevant to the production of bachelor's degrees. Hence, whether an indirect cost item should be totally or partially excluded in the calculation is an important decision. Clearly, all direct costs should be included in the calculation, and all irrelevant costs should be excluded. The trouble, however, lies in the indirect operating costs. Since some of the activities that incur these indirect costs are irrelevant to instruction and student services (e.g., a building used for public service, libraries used for sponsored research, etc.), an appropriate portion should be deducted from this cost category.

How much should be deducted? This is an allocation issue. O'Neill (1969) and Skoro and Hryvniak (1980) deducted an amount equal to 5 percent of the extension expenditure and 15 percent of the organized research expenditure from the sum of direct and indirect costs. This deduction is not well justified; moreover, the assumption is based on an "informal" investigation by Lindsay (1964, p. 50), which is not reliable. Similarly, in a table prepared by Williams for his paper, Schultz (1972) arbitrarily deducted 50 percent of the research expenditure from the sum of direct and indirect costs. The logic behind this adjustment is not clear because no explanation was provided in the paper.

The best way to allocate these indirect costs is to find an appropriate variable that reflects the use of the facilities. In this case, faculty time allocated among teaching, research, and administration seems to be a reasonable choice and has been actually used in some studies, e.g., Bell et al. (1972). However, as mentioned, this allocation variable cannot be used because such data are not available in a large sample size. An alternative method is to assume that the distribution of functional expenditure reflects exactly the pattern of the allocation of faculty time. With this assumption, the following proportion of direct expenditures can be used to allocate joint operating cost to instruction and student services:

$$\alpha = (INS + SS + SF)/(INS + SS + SF + RES + PS) \qquad (1)$$

Hence, the operating cost of degree production (including both undergraduate and graduate degrees) can be calculated by:

$$C^{o} = INS + SS + SF + \alpha JCT \qquad (2)$$

where $JCT = AS + IS + OM + OT$

The allocation variable, α, varies inversely with the proportion of research and public service expenditures; that is, if the institution is a small college with little research activity, then α is close to 1, i.e., all costs are allocated to instruction.

Operating cost is not the only cost incurred during the production process; capital cost comprises at least 10 percent of higher education costs. There are two kinds of capital costs: (1) depreciation costs of buildings and equipment and (2) opportunity cost or foregone interest of land.[9] In this study, only the first cost is included because the estimation of the second cost is difficult. (In HEGIS, only book values of land are reported. These data cannot be used to estimate the opportunity cost because they do not reflect the market values of this land).

To estimate the depreciation costs of buildings and equipment, the following information is needed: (1) the values of these assets; (2) the estimated lengths of the lives of these assets; and (3) the depreciation methods. Because of the lack of data in early years, the estimation is difficult. The major problem is that the "market values" of these assets is unknown. HEGIS provides data on "book values" but such figures, representing the sum of "construction" costs that have been incurred over years, are not useful.

These technical difficulties have been discussed by O'Neill (1969), who constructed a capital series from 1939 to 1967 in replacing these data. The difficulties encountered by O'Neill (1969), however, were partly overcome by the introduction of a new item, "replacement cost" of buildings, in HEGIS finance data. This "replacement cost" is an effective proxy for "market value," and can be used to estimate the depreciation cost.

The "replacement cost" of equipment, however, is not reported. In order to obtain these data, it is assumed that the ratio of the replacement cost of equipment to buildings is 0.18 for public institutions and 0.14 for private institutions. These assumptions are based on the evidence in table 3,[10] from 1975-76.

It is also assumed that buildings last for 50 years and equipment for 20 years.[11] Applying the straight-line depreciation method, the depreciation costs of buildings and equipment are estimated by the following formulae:

$$DBUI = (1/50) \cdot BUI \qquad (3)$$

$$DEQP = (1/20) \cdot EQP = (1/20)(\theta \cdot BUI) \qquad (4)$$

where θ is 0.18 for public institutions and 0.14 for private institutions. BUI and EQP are replacement costs of buildings and equipment respectively.

The total capital cost (KCOST = DBUI + DEQP) is allocated to instruction and student service by using allocation variable, α , and the allocated amount is then added to the total operating cost. The sum is the total cost of degree production:

$$C^T = INS + SS + SF + \alpha(JCT + KCOST) \qquad (5)$$

This includes both undergraduate and graduate costs. The next step is to allocate this cost to undergraduate programs.

While no allocation method is perfect, one way is to allocate cost according to its share. Assume that cost is separable, and can be expressed by:

$$C = Cu\ FTEU + Cg\ FTEG$$

where Cu and Cg are unit costs for undergraduate enrollment (FTEU) and graduate enrollment (FTEG) respectively.

Table 3. — Ratio of Net Values of Equipment to Net Values of Buildings and Improvements by Control, 1929-30 to 1976-77

End of fiscal year	Public	Private
1929-30	0.11	0.05
1939-40	0.12	0.07
1949-50	0.14	0.09
1959-60	0.16	0.12
1969-70	0.17	0.12
1975-76	0.18	0.14

SOURCES: 1929-30 to 1959-60: O'Neill [1969], table C-5.
1969-70 to 1975-76: Skoro and Hryvniak [1980], table A6.

21

Then the share of undergraduate cost is:

$$\beta = \frac{FTEU}{FTEU + \delta \; FTEG} \qquad (6)$$

where $\delta = Cg/Cu$

The exact value of δ is unknown, though it is believed to be greater than 1 (descriptive cost studies show that more advanced instruction usually incurs higher cost[12]). The evidence from scattered case studies shows that the cost ratio may vary among institutions. On the average, it is close to 3. This hypothesis was widely supported by Bowen (1980, p. 265), the Carnegie Commission (1972), and O'Neill (1969).[13] Opposition to this hypothesis can also be found in University of California (1960) and Bell et al. (1972) where δ is believed to include a wide range from 2.14 to 6. A survey by Brinkman (1985b) also shows that δ may vary with type of institution. As indicated in table 4, the cost ratios in institutions with large research and graduate programs are larger than those in small colleges.

For convenience, δ equals 3 in this study. However, a sensitivity analysis and some tests on δ by using regression techniques will be conducted in part 4 to show the validity of this assumption as well as the impacts of the changes in δ on the results.

With this assumption, the production cost can be estimated by the following equation:

$$C = \beta \; [INS + SS + SF + \alpha\,(JCT + KCOST)] \qquad (7)$$

Cost of a Bachelor's Degree

Since no data on the total credits offered by the institutions each year are available, the only method to use is to convert the enrollment data into credit data. To do so, some assumptions on the number of credits taken by the average student each year must be made. Then, this number will be multiplied by the total full-time-equivalent undergraduate enrollment.

A reasonable assumption is that each full-time-equivalent student takes 30 credits a year (credits refer to semester credits). This assumption is based on the fact that, if the student takes 30 credits per year, then he or she will complete 120 credits and obtain a bachelor's degree in 4 years.[14] With this assumption, the data on FTE undergraduate enrollment (FTEU) can be converted into total undergraduate credits:[15]

$$H = 30 \cdot FTEU \qquad (8)$$

By dividing the total cost in equation (7) by the total undergraduate credits in equation (8), "cost per credit" can be estimated. This "cost per credit" is then multiplied by 120 to yield the "production cost of a bachelor's degree." Since 120 credits are the minimum number of credits required for bachelor's degrees, the cost obtained is the "subsistence" cost which barely meets the minimum requirements. Different definitions of bachelor's degrees and adjustments will be discussed in part 5.

Table 4. — Cost Ratios per Credit Hour by Level of Instruction

Type of institution	Direct Cost[1]			Full Cost[1]		
	MA : BA[2]	PHD : BA	G : U	MA : BA[2]	PHD : BA	G : U
Baccalaurate	1.48	-	-	1.55	-	-
Comprehensive	2.17	3.46	-	2.16	2.49	-
Doctoral	2.87	6.90	3.44	2.62	3.54	3.23
Research	2.73	4.86	3.50	2.07	3.12	3.00
Doctoral & Research	2.62	6.20	3.46	2.45	3.37	3.11

NOTE.- [1] Direct cost includes only instruction expenditures. Full cost includes all expenditures related to instruction.

[2] MA = master-level cost; BA = bachelor-level cost and BA = U; PHD = doctoral-level cost; G = graduate-level cost.

- Data not available.

SOURCE: Brinkman [1985b], table 1.
The data are converted by defining $BA/L=1/2[(U/L)+1]$ where U/L is the cost ratio of upper-division and lower-division undergraduate programs and by using the formula: $MA/BA = 1/[1/2((U/L)+1)]\cdot(G1/L)$

Analysis of Results

Major Findings

Two kinds of costs will be considered in this part: (1) direct costs, which include only instruction expenditures, and (2) full costs, which include both direct costs and allocated costs. There are two reasons for including direct costs here. First, direct costs are more closely related to classroom instruction; hence, this concept is a good indicator for teaching activities. Second, as mentioned earlier in part 1, even with the best allocation method, the potential controversies cannot be totally excluded; direct costs, which do not involve any allocation, avoid such controversy.

The results from the 1983 HEGIS data are summarized in tables 5 and 6. In these tables, three additional statistics alongside the "averages," i.e., the first quartiles, the third quartiles, and the medians, are presented. The presentation of these quartiles seems to be helpful because, as seen in the coefficients of variation, the dispersion of the cost estimates is quite large. The distribution of estimates is skewed to the right with a skewness coefficient equal to 4.89.[16]

The average cost of a bachelor's degree at all institutions in 1983 was $24,713 (table 5). However, this cost varied substantially among different types of institutions. Private baccalaureate institutions seemed to be the most expensive ($30,157), while public comprehensive institutions seemed to be the least ($17,380). On average, the costs of a bachelor's degree were $18,474 at public institutions and $28,386 at private institutions. (The latter were 54% more expensive than the former.) Among all private institutions, the small baccalaureate institutions were the most expensive ($30,157), followed by the large doctoral level institutions ($27,996). The medium-sized, private, comprehensive institutions were less expensive, though they still cost $4,309 more than the least expensive one.

Similar patterns can be found in the direct costs (table 6), except for those at the doctoral-level institutions. It is, however, not surprising to see that the direct costs for these institutions are larger than their counterparts. As shown in table 7, these institutions spent more money on instruction in 1983. The curious question is: How can these institutions keep their full costs down while they are spending enormous amounts of money on instruction? An answer to this question is proposed later in this part of the paper.

The cost variations among regions were not as significant as among types of institutions (see table 8). The most expensive region was the Northeast ($27,669), followed by the North Central ($25,484), the South ($23,284) and the West ($21,935). The comparison among States (appendix table) reveals similar patterns. The five most expensive States or districts were Alaska ($42,212), Maine ($32,542), District of Columbia ($31,448), Vermont ($29,893), and New York ($29,767). The five least expensive were Puerto Rico ($12,695), Nevada ($17,565), Arizona ($18,337),

Table 5. — Full Institutional Cost of a Bachelor's Degree by Control and by Type of Institution, 1983

Type of institution	Average	1st Quartile	Median	3rd Quartile	N[a]	C.V.[b]
All institutions	$24,713	$16,836	$21,989	$29,381	1,271	53
All public	18,474	14,615	17,245	21,220	471	31
Doctoral	18,271	15,095	17,435	20,746	102	24
Comprehensive	17,380	14,026	16,592	19,865	249	30
Baccalaureate	20,918	15,895	19,400	25,678	120	33
All private	28,386	20,274	25,937	33,556	800	52
Doctoral	27,996	19,140	26,302	35,131	56	43
Comprehensive	21,689	14,867	18,819	23,153	153	79
Baccalaureate	30,157	22,442	27,561	34,780	591	46

[a] N: number of institutions.
[b] C.V.: coefficients of variation (%).

Table 6. — Direct Institutional Cost of a Bachelor's Degree by Control and by Type of Institution, 1983

Type of institution	Average	1st Quartile	Median	3rd Quartile	N[a]	C.V.[b]
All institutions	$8,691	6,518	$7,928	$9,885	1,271	45
All public	8,218	6,634	7,818	9,436	471	28
Doctoral	9,827	7,632	9,591	11,143	102	26
Comprehensive	7,711	6,374	7,571	8,739	249	27
Baccalaureate	7,902	6,389	7,605	9,068	120	25
All private	8,970	6,420	8,069	10,247	800	51
Doctoral	13,666	8,323	11,977	16,479	56	55
Comprehensive	7,951	5,404	6,948	8,677	153	63
Baccalaureate	8,789	6,610	8,240	10,169	591	43

[a] N: number of institutions.
[b] C.V.: coefficients of variation (%).

Table 7. — Selected Characteristics of Institutions by Type and by Control, 1983

Characteristic	Public & private	Public				Private			
		All public	Doctoral	Comprehensive	Baccalaureate	All private	Doctoral	Comprehensive	Baccalaureate
AINS	$ 2,587	$ 2,498	$ 3,376	$ 2,332	$ 2,098	$ 2,639	$ 6,088	$ 2,765	$ 2,280
ARES	352	481	1,573	208	119	275	3,175	135	37
APS	167	253	660	150	121	116	415	213	62
ASS	556	359	349	334	419	672	596	551	710
ASF	939	473	461	404	629	1,213	1,453	928	1,265
AJCT	2,597	2,001	2,397	1,854	1,969	2,948	4,617	2,942	2,792
AEG	7,198	6,065	8,815	5,282	5,354	7,864	16,346	7,534	7,146
AKCOST	719	567	664	505	614	808	1,127	600	832
ATUI	3,225	1,168	1,172	1,058	1,107	4,421	6,437	4,673	4,165
AREV	9,236	7,426	11,381	6,339	6,331	10,312	28,292	9,114	8,905
SAL	23,347	26,891	30,757	26,779	23,835	21,260	30,300	23,501	19,823
FTE	4,473	8,450	19,498	6,794	2,494	2,133	9,467	3,236	1,152
STUFAC	20	22	21	21	23	20	21	24	19

NOTE.- AINS: instruction expenditures per FTE enrollment.
ARES: research expenditures per FTE enrollment.
APS: public expenditures per FTE enrollment.
ASS: student service expenditures per FTE enrollment.
ASF: scholarship and fellowship expenditures per FTE enrollment.
AJCT: indirect expenditures per FTE enrollment.
AEG: total education and general expenditures per FTE enrollment.
AKCOST: capital cost per FTE enrollment.
ATUI: tuition revenue per FTE enrollment.
AREV: total current fund revenue per FTE enrollment.
SAL: total salary outlay and fringe benefits expenditures per faculty member.
FTE: full-time-equivalent enrollment.
STUFAC: student-faculty ratio.

Table 7. — Selected Characteristics of Institutions by Type and by Control, 1983 — Continued
(In Percents)

Characteristic	Public & Private	Public				Private			
		All public	Doctoral	Comprehensive	Baccalaureate	All private	Doctoral	Comprehensive	Baccalaureate
PINS	38	43	40	46	41	34	39	39	32
PRES	3	5	15	3	2	2	14	1	0
PPS	2	3	7	2	2	1	2	1	1
PSS	8	6	4	7	8	9	4	8	10
PSF	13	8	6	8	12	16	10	13	18
PJCT	36	34	28	35	36	38	31	37	39
PASD	6	7	3	5	14	5	1	3	6
PBSD	79	75	68	75	80	82	51	63	90
PMSD	12	16	21	20	6	10	31	29	3
PPHD	3	2	8	1	0	3	17	5	1
PFED	10	11	13	9	11	10	14	7	10
PSTATE	19	50	43	53	49	2	2	2	1
PLOC	0	1	0	1	1	0	1	0	0
PPRIV	11	2	4	2	1	17	14	12	18
POTHER	60	36	40	35	38	71	69	79	71
PFTEG	9	10	18	11	3	9	37	22	2
PKCOST	11	10	8	10	11	10	7	8	11
PART	13	16	11	17	16	11	11	19	9
COMP	76	69	78	71	60	81	94	88	79
PROF	55	60	68	61	61	52	65	55	50

NOTE.- PINS: percent of instruction expenditures in total E & G expenditures.
PRES: percent of research expenditures in total E & G expenditures.
PPS: percent of public service expenditures in total E & G expenditures.
PSS: percent of student service expenditures in total E & G expenditures.
PSF: percent of scholarship and fellowship expenditures in total E & G expenditures.
PJCT: indirect expenditures as a percentage of total E & G expenditures.
PASD: percent of associate degrees in total number of degrees conferred.
PBSD: percent of bachelor's degrees in total number of degrees conferred.
PMSD: percent of master's degrees in total number of degrees confered.
PPHD: percent of doctoral degrees in total number of degrees conferred.
PFED: percent of total current funds revenues from federal government.
PSTATE: percent of total current funds revenues from state government.
PLOC: percent of total current funds revenues from local government.
PPRIV: percent of total current funds revenues from private gifts, grants and contracts, and endowment income.
POTHER: percent of total current funds revenues from tuition, fees, and other sources.
PFTEG: percent of FTE graduate enrollment in total FTE enrollment.
PKCOST: capital cost as a percentage of total E & G expenditures.
PART: percent of part-time enrollment in total enrollment.
COMP: percent of students who completed baccalaureate programs.
PROF: percent of full professors in faculty.

SOURCE: Compiled from Higher Education General Information Survey (HEGIS).

Table 8. — Institutional Cost of a Bachelor's Degree and Selected Variables by Region, 1983

Variable	Northeast	North Central	South	West
Average Cost	$27,669	$25,484	$23,284	$21,935
	(55)	(58)	(40)	(47)
FTE	4,069	4,425	3,811	5,938
PFTEG	10	7	7	15
ATUI	$ 4,261	$ 3,400	$ 2,457	$ 2,631
STUFAC	23	20	19	20
PROF	61	61	54	63
SAL	$27,440	$24,154	$23,356	$26,308
PINS	37	37	37	40
PRES	4	4	5	6
Number of institutions	341	354	319	243

NOTE.- Numbers in parentheses are coefficients of variation.

Colorado ($18,710), and Utah ($18,989). The cost estimates for all other States and districts are listed in the appendix table. In general, the costs in the Mountain or Southern States were much lower than those in the Great Lakes or New England areas.

The causes of these regional variations are not clear. However, two factors seem to have contributed to the differences: (1) the structure of higher education in each State and (2) the variation of costs of living among regions. While the impacts of costs of living are evident, e.g., the costs in the Northeast and New England areas are higher than those in the South, the impact of the differences in higher education structures among States needs further explanation. On average, the costs for public institutions are lower than those for private institutions. Therefore, a State heavily relying on a public higher education system should have lower costs than its counterparts. The data in the appendix table seem to support this reasoning. Except for Alaska and Puerto Rico, in which the cost of living is either extremely high or extremely low, all of the other four most costly States or districts (Maine, D.C., Vermont, and New York) have more private institutions than public institutions. The opposite is found in the other four least expensive States.

Finally, from the coefficients of variation in tables 5 and 6, there is more homogeneity among the public institutions than the private institutions. The most diversified institution is the private comprehensive institution, which has a high coefficient of 79 percent. The cost structure of these institutions may vary widely, just as the costs of their bachelor's degrees.

Characteristics of Institutions

Why do the costs of bachelor's degrees differ so tremendously among institutions? A possible answer is that institutions differ in many aspects. Table 7 summarizes the major characteristics of institutions (note: the notations in table 7 follow those used in the preceding parts of this paper. Variables preceded by the letter "A" represent "amount per FTE enrollment" and variables preceded by the letter "P" represent "percentage" or "proportion"):

1. Doctoral-level institutions: These institutions are the largest, usually with a full-time-equivalent (FTE) enrollment exceeding 9,000 students. The proportions of graduate students (PFTEG) are comparatively high (18 percent for public and 37 percent for private institutions). More than 30 percent of the degrees conferred are doctoral (PPHD) or master's degrees (PMSD); slightly over one-half of the degrees are bachelor's degrees (PBSD); the percentages of associate degrees (PASD) are insignificant. The institutions evidently spend more money on research (PRES) and public service (PPS) and less on student services (PSS), scholarships (PSF), and joint operating costs (PJCT). The capital costs, measured as a percentage of total educational and general expenditure, are the lowest. The institutions are the most affluent among all types;

as can be seen from all the expenditures measured "per FTE unit" (i.e., AINS, ARES, etc.) in table 7, the amounts spent by these institutions are much larger than those spent by other types of institutions. The current revenues per FTE (AREV) are $11,381 for public and $28,292 for private institutions. Because of the plentiful resources, they are able to hire more senior faculty. Sixty-eight percent of the faculty in public institutions are full professors (PROF). This percentage is 65 percent for private institutions. Salaries and fringe benefits per faculty member (SAL) are $30,757 for public and $30,300 for private. In order to finance the enormous costs, these institutions charge their students higher tuitions. The tuitions and fees per FTE student (ATUI) are $1,172 at public and $6,437 at private institutions.

2. General baccalaureate institutions: These institutions are the smallest, basically focusing only on undergraduate education (low PFTEG). In contrast with doctoral-level institutions, these institutions spend almost no money on research (PRES is close to zero) but large proportions on student services (PSS), scholarships (PSF), and joint operating costs (PJCT). Faculty are usually low paid and have less experience (as reflected in SAL and PROF).

3. Comprehensive institutions: These institutions comprise the major part of the higher education system and can serve as the "representative" group. Average FTE enrollments are 6,794 for public institutions and 3,236 for private institutions. These institutions basically focus on undergraduate education, but also maintain significantly large master's programs (PMSD). Like the general baccalaureate institutions, they spend very little money on research (PRES) but quite large portions of their budgets are used for student services (PSS) and joint operating costs (PJCT). The faculty members have less experience than those in doctoral-level institutions but are more competitive in terms of salaries and experience than those in general baccalaureate institutions.

Among all types of institutions, the private, doctoral-level institutions seem to be unique. These are the most affluent and prestigious institutions heavily engaged in research and graduate programs (37 percent of the students are graduate students; 14 percent of the total educational and general expenditures are used for research). The instruction expenditures per FTE enrollment (AINS) are high ($6,088), and so are the tuitions charged (ATUI) ($6,437).

In comparing public institutions to private institutions there is little difference in instruction expenditure per FTE enrollment. Private institutions' revenues are somewhat higher than those of public institutions, and their class size, measured by student/faculty ratio (STUFAC), is somewhat smaller (20 vs. 22). On the other hand, public institutions have more senior faculty (larger PROF) and more part-time students (PART). The basic difference however, lies in the following:

1. Different sources of revenue: While public institutions get most of their money from State governments, private institutions get most of their funding from the private sector. The percentages of State government appropriations, grants, and contracts of total current revenues (PSTATE) are 50 percent for public institutions and 2 percent for private institutions. (Note: Total current revenue here includes all revenues accruing to the institutions, such as sales and services of auxiliary enterprises and hospitals, etc.) On the other hand, the percentages of endowment, private gifts, and contracts of total current revenues (PPRIV) are 2 percent for public and 17 percent for private. The percentages of total Federal and local appropriations, grants, and contracts (PFED and PLOC) are about the same for both public and private (about 10 percent).

2. Different expenditure patterns: public institutions and private institutions do not have the same spending patterns. Public institutions spend relatively more money on research and public service, while private institutions spend more on student services and scholarships. Because of the smaller size (in terms of FTE enrollment, 2,133 vs. 8,450), private institutions have to finance a larger portion of joint operating costs (PJCT), including administration, libraries, etc. As a result, the proportion of instruction expenditure in total educational and general expenditure (PINS) is lower at private institutions (34 percent) than at public institutions (43 percent).

3. Different completion rates: a rough estimate for completion rate can be found by dividing the number of bachelor's degrees by FTE undergraduate enrollment and then multiplying the quotient by 4.[17] As seen in table 7, this completion rate (COMP) is 81 percent for private and 69 percent for public institutions. In other words, more students drop out of public institutions.

Determinants of Cost

How do the major characteristics of institutions affect the costs of bachelor's degrees? To answer this question, we classify the institutions by three groups, according to their full costs of bachelor's degree: low-, medium-, and high-cost groups.

The procedure is as follows: (1) rank the institutions by their full costs of bachelor's degrees; (2) classify the lowest 25 percent of these ranked institutions as the "low-cost group," the highest 25 percent as the "high-cost group," and the ones in between (25 percent to 75 percent) as the "medium-cost group;" and (3) calculate some selected variables believed to be the major characteristics of each group. The results are listed in table 9.

Larger cost variation is found in full costs rather than direct costs. As shown in table 9, the direct cost for the high-cost group is double that for the low-cost group, while the full cost of the high-cost group

Table 9. — Characteristics of Institutions with Low, Medium, and High Costs, 1983

Characteristic	Cost Group		
	Low	Medium	High
Full Cost	13,720	22,385	40,356
Direct Cost	6,107	8,223	12,211
FTE	7,183	4,495	1,721
PFTEG	0.15	0.08	0.05
PART	0.21	0.13	0.06
STUFAC	27	20	15
PINS	0.44	0.37	0.32
PRES	0.03	0.03	0.02
PPS	0.03	0.02	0.01
PSS	0.07	0.08	0.09
PSF	0.09	0.14	0.17
PJCT	0.34	0.36	0.39
SAL	24,507	22,001	22,876
AEG	4,661	6,617	10,984
ATUI	1,820	3,059	4,960
AINS	1,972	2,444	3,488
ASF	419	853	1,632
PROF	0.55	0.55	0.54
COMP	76	76	84
PFED	9	11	10
PSTATE	35	19	5
PLOC	0.2	0.3	0.6
PPRIV	4	10	21
AREV	5,654	8,396	14,553

is almost triple. This implies that the major sources of the cost variation do not come from the variation of instruction expenditures, but from other expenditures, such as those for libraries, buildings, and administration, that is, from the indirect costs.

Affluence and prestige are considered to be the major causes of high costs. This hypothesis is verified by the values of some variables, which measure the affluence of institutions. As shown in table 9, the values of these variables are larger for the high-cost group: (1) the revenue per FTE (AREV), (2) the total E&G expenditure per FTE (AEG) and (3) the tuitions and fees per FTE (ATUI). In other words, affluence seems to play an important role in cost determination. In fact, in order to help students finance their prestigious educations, these high-cost institutions usually provide more scholarships and fellowships (PSF). The proportion of these expenditures in total E&G expenditure for the high-cost group is 17 percent compared to 9 percent for the low-cost group. More student services (PSS) could also be expected from these institution but the difference is not substantial (9 percent vs. 7 percent).

The large shares of scholarships and joint operating costs seem to be a burden in these institutions' budgets. A lot of money has to be taken from instruction, despite the fact that these institutions do not have a heavy cost burden for public service and research (the sum of PRES and PPS is 3 percent for the high-cost group compared to 6 percent for the low-cost group). The proportion of instruction expenditure is only 32 percent for the high-cost institutions compared to 44 percent for the low-cost institutions.

The other source of cost variation is from the student-faculty ratio (STUFAC) or average class size. A significant difference in these ratios can be found in table 9. The low-cost institutions have the largest student-faculty ratio (27 students per faculty member), about 12 students more than in high-cost institutions. Therefore, there is clearly a tradeoff between student-faculty ratio and cost. The point is whether the additional cost (in this case, $26,636) is worthwhile in terms of teaching effectiveness. The proportion of part-time students in total enrollment (PART) is also an important factor in cost determination: the higher the part-time proportion, the lower the cost.

Finally, the most important factor, is "economies of scale," that is, the larger the size of the institution (in terms of FTE enrollment), the lower the cost. The existence of economies of scale in higher education has long been recognized.[18] The average full-time-equivalent enrollment for the low-cost institutions is 7,183 students, while, for the high-cost institutions the enrollment is only 1,721 (table 9). Even more apparent evidence can be found in table 10, where the cost of a bachelor's degree is estimated for various groups of institutions by size. This table shows a tremendous decrease in full cost as the size of the institution increases from 200 to 500 students; then the decrease in cost slows down as the size increases. The production cost begins to level off once the size exceeds 5,000 students. The expansion in size over 5,000 students still reduces the cost but only at a minimal level. Although the lack of sufficient data on these large universities prevents the determination of an optimal (at minimum cost) size, the data in table 10 suggest that it may be somewhere beyond 20,000 students.[19]

Table 10 also reveals that direct costs reach a minimum at a scale from 2,500 to 5,000 students, and the economies of scale are also not as evident as for the full costs. These results are understandable because economies of scale are usually found in fixed or indirect costs rather than in variable costs, which in this case are largely instruction expenditures.

Some regressions that were run show the effects of major institutional characteristics on costs. The cost function to be estimated was assumed to be a double log function of FTE enrollment, with the following as control variables: (1) proportion of graduate enrollment (PFTEG); (2) proportion of part-time enrollment (PART); (3) proportion of research and public service (PRES & PPS); (4) proportion of instruction expenditure (PINS); (5) joint operating cost per FTE (AJCT); (6) tuitions and fees per FTE (ATUI); (7) proportion of full professors in faculty (PROF); (8) student-faculty ratio (STUFAC); (9) total current revenue per FTE (AREV); and (10) salaries and fringe benefits per faculty member (SAL). These explanatory variables were selected based on the preliminary runs of stepwise regressions. Variables (1) to (5) show the structure of the institutions, while variables (6) to (10) measure the "affluence effects." Two dummy variables, D1 and D2, were included to represent the types of institutions, i.e., (0,0) for baccalaureate, (1,0) for comprehensive, and (0,1) for doctoral-level institutions. The regression results are summarized in table 11.

The regression results basically conform to the results in table 9. The "affluence effects," measured by the five variables (ATUI, SAL, STUFAC, PROF, AREV), are all significant, and all the coefficients of these variables carry the expected signs. The "structure effects" measured by the coefficients of the variables, PFTEG, PART, AJCT, PRES+PPS, and PINS also carry the expected signs and most of them are significant. However, there are some differences between the regression results for the public and the private institutions. Note that the coefficients of STUFAC and PROF are not significant (at 5 percent critical level) for the public institutions. In other words, student-faculty ratio and the proportion of full professors in the faculty are not really important in determining the public institution's costs. One possible explanation is that the class size and the proportion of senior faculty do not play an important role because they are about the same for all public institutions, i.e., each public institution has almost the same class size and proportion. On the other hand, the coefficient of (PRES + PPS) is not significant for the private institutions; that is, the proportion of research and public service expenditure does not seem to be important in this case.

The coefficient of log FTE is, theoretically, the "cost elasticity," i.e., the percent change in cost in response to one percent increase in enrollment. Since the elasticities in table 11 are negative, an increase in enrollment reduces the production cost of a bachelor's degree. In other words, economies of scale exist in both private and

Table 10. — Institutional Cost of a Bachelor's Degree by Size of Institution, 1983

Size of institution (number of FTE students)	Full cost	Direct cost	Number of institutions
0-200	$64,174	$15,684	16
200-500	32,164	8,749	84
500-1,000	29,441	8,404	259
1,000-2,500	26,221	8,736	377
2,500-5,000	19,186	7,687	200
5,000-10,000	18,946	8,642	173
10,000-20,000	18,640	9,455	114
20,000 or over	18,074	10,010	48

Table 11. — Regressions of Cost of Bachelor's Degrees on Institutional Characteristics

Dependent variable = full cost of a bachelor's degree (in logarithms)

Independent variable	Public	Private
Constant	9.4626	10.5351
log (FTE)	-0.0208	-0.1263
	(-1.64)	(-11.39)
PFTEG	-0.0128	-0.0110
	(-11.65)	(-13.73)
PART	-0.1699	-0.6220
	(-2.32)	(-8.89)
ATUI	5.29 E-05	7.98 E-05
	(4.03)	(16.02)
AJCT	0.0001	4.77 E-05
	(14.14)	(17.54)
SAL	5.63 E-06	6.15 E-06
	(2.13)	(5.14)
PROF	0.0794	0.1611
	(1.34)	(3.82)
PINS	-0.0019	-0.0004
	(-1.30)	(-0.45)
STUFAC	-0.0004	-0.0033
	(-0.85)	(-7.19)
PRES + PPS	-0.0093	-0.0028
	(-7.88)	(-1.56)
AREV	3.05 E-05	2.33 E-06
	(9.38)	(3.29)
D1	-0.0240	-0.0345
	(-1.17)	(-1.41)
D2	0.0161	0.2385
	(0.63)	(6.21)
R^2	0.7917	0.8131
F	133.57	262.96
number of observations	470	799

NOTE.- Figures in parentheses are t-statistics.

public institutions. It is also interesting to find the cost elasticity is larger for private institutions (in fact, the coefficient for public institutions is not significant). The results in table 11 indicate that a 1 percent increase in enrollment can reduce the cost in private institutions by 0.13 percent, but only 0.02 percent in public institutions. This result is not surprising because the average size of the private institutions is much smaller than the public (see FTE in table 8). As shown in table 10, economies of scale are more evident with a smaller scale and less evident with a scale exceeding 5,000 students. The average FTE enrollment for public institutions is 8,450. With this large scale, the benefit from further expansion is slight.

In sum, the following factors seem to be critical in the cost determination: (1) the composition of students: the larger the proportion of part-time and graduate students, the lower the cost is;[20] (2) the class size: larger classes save money; (3) affluence and prestige: rich institutions tend to spend more; and (4) the size of institution: economies of scale exist.

Financing a College Degree

Students, parents, and taxpayers are anxious to see what their shares (burdens) are in the cost of a bachelor's degree. Because of limited data and assumptions, such information cannot be provided by this paper. Instead, rough indicators are presented in table 12, to show how much a student has to pay if he or she attends a particular type of institution. (Some indicators were calculated with assumptions because of the lack of appropriate data.)

The first indicator, "tuition/full cost," was calculated by multiplying tuitions and fees per FTE by 4 and then dividing the product by full cost. This indicator roughly shows the total tuition payment as a percentage of product cost, that is, the institution's dependence on tuition revenue.[21] The second indicator, "aids/full cost," was derived by multiplying scholarships and fellowships per FTE by 4 and then dividing the product by full cost. This indicator represents the portion of cost that is financed by scholarships and fellowships. Therefore, the burden for the students in financing college education can be expressed as the difference between the two ratios, "tuition/full cost" and "aids/full cost" (that is, the "portion that the students paid" minus the "portion that the students received" for financing their college education). The burden ratio is listed in column 3 in table 12. This ratio (percentage) represents the shares that the students and parents pay for their bachelor's degrees. The amount of money paid can be calculated by multiplying this ratio by full costs (column 4).

The data in table 12 show that, on average, students pay 37 percent of the production cost of a bachelor's degree, i.e., $9,144 out of the total $24,713 cost. About 15 percent of the costs are paid through financial aid. However, the students can save significant amounts of money if they choose to attend public institutions, especially the small colleges. Students attending public institutions pay 15.2 percent (or $2,808) of the total cost; those attending private institutions, however, pay

Table 12. — Student's Burden and Selected Financial Ratios by Type of Institution

Type of institution	Tuition/ full cost (%)	Aid/ full cost (%)	Burden ratio (%)	Student's burden	Direct cost/ full cost (%)
All institutions	52.2	15.2	37.0	$9,144	35.2
All public	25.4	10.2	15.2	2,808	44.5
Doctoral	25.6	10.1	15.5	2,832	53.8
Comprehensive	26.9	9.3	17.6	3,059	44.4
Baccalaureate	20.2	12.0	8.2	1,715	37.8
All private	62.3	17.1	45.2	12,830	31.6
Doctoral	92.0	20.8	71.2	19,933	48.8
Comprehensive	86.2	17.1	69.1	14,987	36.7
Baccalaureate	55.2	16.8	38.4	11,580	29.1

SOURCE: See text.

about half of the total (45.2 percent or $12,830). The most expensive are the private doctoral-level institutions where the students pay $19,933, about 71.2 percent, for their degrees. Although they have 20.8 percent of their costs paid by scholarships and fellowships, the burden on the student is still large because these institutions rely heavily on tuition revenues (92 percent). The least expensive degrees are available in the public baccalaureate institutions where the students pay 8.2 percent or $1,715 of the total cost.

The decision about where to go to college should not be made simply by considering the costs. The students should compare the benefits from the degrees (education) with the burdens listed in table 12. Quality is one of the important considerations. The content of education and cost structure are different from institution to institution. For example, small colleges (baccalaureate) spend a large proportion of their money on indirect costs, contrary to the common perception that they spend most of their resources on classroom instruction. As a matter of fact, the direct cost/full cost ratios for these small baccalaureate institutions are the lowest among all institutions. (The most astonishing result is that the small, private baccalaureate institutions, which have an average of 1,152 students, spend more than 70 percent of their resources on administration, building maintenance, and other academic supporting activities. As shown in table 12, the direct cost/full cost ratio for these institutions is 29.1 percent. The reason for this low ratio is simple: how can we expect more money to be spent on instruction while the institutions are struggling with their budgets to keep the basic facilities for a small class?

Who is supporting these high-cost institutions? The data in table 9 show that 21 percent of the costs of these institutions are financed by the private sector (PPRIV); 10 percent by the Federal government (PFED); and 5 percent by State governments (PSTATE). On the other hand, the cost of low-cost institutions is supported by State governments (35 percent); the Federal government (9 percent); and private gifts, grants and contracts, and endowment income (4 percent).

Trends of the Costs of Bachelor's Degrees

Studies on the costs of bachelor's degrees are scarce, if not unavailable. However, to reveal the trends of these costs, data on "cost per credit" from O'Neill (1969) and Skoro and Hryvniak (1980) were multiplied by 120 credits to yield the estimates, shown in table 13, from 1930 to 1975. Estimates in 1983 were taken from the results of this study.

Table 13 shows the cost of bachelor's degrees increasing steadily over time, with a relatively large increment from 1975 to 1983. (Note: different methodologies used for these estimates account for the large increment.) No trend is evident in the cost ratios between public and private institutions.

Table 13. — Institutional Cost of a Bachelor's Degree, 1930-1983
(1983 constant dollars)

Year	Public & private	Private	Public	Private/public ratio
1930	$13,562	$14,927	$12,239	1.22
1940	13,562	16,457	11,247	1.46
1950	12,322	13,149	11,619	1.13
1960	15,299	16,622	14,389	1.16
1970	17,820	21,385	16,403	1.30
1975	18,772	21,514	17,815	1.21
1983	24,713	28,386	18,474	1.54

* All data are deflated by using consumer price index.

SOURCES: 1930-1960: O'Neill [1969], appendix E. Data are calculated by multiplying cost per credit by 120.
1970-1975: Skoro and Hryniak [1980], table 5 and table A3. Data are calculated in the following way: (1) total costs in table 5 are divided by number of credits in table A3 to yield data on cost per credit and (2) cost per credit is multiplied by 120. All data refer to data with "weight 3:1."
1983 : This study, table 5.

An Assessment

Sensitivity Analysis

As mentioned in part 1 allocating costs to undergraduate programs cannot be done perfectly, which is to say that all allocations are arbitrary. Hence, it is important to know how this "arbitrariness" (i.e., the assumption on δ) affects our results. A sensitivity analysis of the parameter δ was conducted for this purpose.

Table 14 shows how the costs of a bachelor's degree can be affected by the change in the cost ratio of graduate to undergraduate students (δ). As expected, the cost decreases as δ increases ($\partial\beta/\partial\delta < 0$ in equation (6)). In other words, if the graduate cost is the same as undergraduate cost, i.e., $\delta = 1$, then the cost of a bachelor's degree will be $28,463, about 15 percent more than the cost obtained with the assumption $\delta = 3$ in the preceding parts of this paper. As indicated by equation (6), for those institutions with larger proportions of graduate students, the effects of the change in δ are larger.[22] To verify this, the institutions were classified into four groups by their proportions of graduate students:

(1) G_0 (PFTEG=0); (2) G_1 ($0 < \text{PFTEG} \leq 5\%$); (3) G_2 ($5\% < \text{PFTEG} \leq 30\%$) and (4) G_3 (PFTEG $> 30\%$).

Table 14 shows that all cost ratios, $G_1 : G_0$, etc. decline as δ increases; in other words, an overestimated δ may underestimate the cost for institutions with large proportions of graduate students and overestimate the cost for institutions with small proportions. Since different types of institutions do not have the same proportions of graduate students, any bias in the estimation of δ will affect the cost comparison among institutions.

An Alternative Cost Ratio

It is convenient, but not necessarily appropriate, to assume a uniform cost ratio (δ) for all institutions. Table 4 suggests that these ratios are not the same for various types of institutions. The following cost function tests this hypothesis. If it is assumed that the institution minimizes its instruction cost subject to a Cobb-Douglas production function with undergraduate students (FTEU) and graduate students (FTEG) as outputs, i.e., $(\text{FTEU})^{\alpha_1}(\text{FTEG})^{\alpha_2} = f(\vec{X})$ where $f(\vec{X})$ is a Cobb-Douglas function of a vector of inputs, $\vec{X}$, then, the instruction cost function is as follows:[23]

$$\text{INS} = A_0\,(\text{FTEU})^{a_1}(\text{FTEG})^{a_2}$$

or in logarithms:

$$\log(\text{INS}) = \log A_0 + a_1 \log(\text{FTEU}) + a_2 \log(\text{FTEG}) \qquad (9)$$

Table 14. — Effects of Changes In δ On Institutional Cost of Bachelor's Degrees

Value of δ	Cost of bachelor's degree			Cost ratio*		
	Public & private	Public	Private	G1 : G0	G2 : G0	G3 : G0
0.5	$30,176	$23,509	$34,101	0.90	0.89	1.60
1.0	28,463	22,129	32,193	0.88	0.83	1.23
1.5	27,212	20,997	30,872	0.87	0.77	1.01
2.0	26,223	20,037	29,866	0.86	0.72	0.86
2.5	25,407	19,206	29,058	0.85	0.68	0.75
3.0	24,713	18,474	28,386	0.85	0.65	0.66
3.5	24,111	17,823	27,814	0.84	0.62	0.60
4.0	23,581	17,237	27,317	0.83	0.59	0.54
4.5	23,108	16,705	26,878	0.82	0.56	0.50
5.0	22,683	16,220	26,487	0.81	0.54	0.46

* Institutions are classified by proportion of graduate FTE enrollment in total FTE enrollment:
G0: proportion = 0
G1: $0 < \text{proportion} \leq 5\%$
G2: $5\% < \text{proportion} \leq 30\%$
G3: $\text{proportion} > 30\%$

From this cost function, the ratio of the marginal costs of the two outputs, FTEG and FTEU can be estimated:

$$\delta = \frac{\partial(\text{INS})/\partial(\text{FTEG})}{\partial(\text{INS})/\partial(\text{FTEU})} = \frac{a_1}{a_2} \cdot \frac{\text{FTEU}}{\text{FTEG}} \qquad (10)$$

In other words, δ can be estimated with the estimates of a_1 and a_2. With this concept, the following regression has been run by using OLS (ordinary least squares):

$$\log(\text{INS})_i = a_0 + a_1 \log(\text{FTEU})_i + a_2 \log(\text{FTEG})_i + a_3 (\text{STUFAC})_i + a_4 (\text{AEG})_i + a_5 D_i + e_i \qquad (11)$$

where STUFAC and AEG are student-faculty ratio and total expenditure per FTE respectively; D is a dummy variable (D=1 for private institutions); e_i is the disturbance term.

The regression results in table 15 are interesting.[24] Using the coefficients a_1 and a_2 and the mean values of FTEU and FTEG, the cost ratios, which are listed in the last row of table 15, can be calculated. As indicated, the cost ratio is 3.44 for doctoral-level institutions, 2.01 for comprehensive institutions, and 1.21 for general baccalaureate institutions. These results confirm the hypothesis that the cost ratio is larger for institutions with large proportions of graduate students. Given the fact that small institutions' graduate programs are insignificant in their academic focus, less money is invested in them. As a result, for these institutions the cost ratio should be low. On the other hand, the cost ratio for doctoral-level institutions should be higher than that for the comprehensive institutions because the former usually focus on doctoral programs which cost much more than the master's programs that the latter supports. Although the difference in these cost ratios looks large, it may not affect the results a great deal because the weighted average of these ratios (with FTEG as weights) is 3.16, which is very close to what has been assumed in the previous parts of this paper.

To verify this statement, the estimated cost ratios, δ, in table 15 have been used, and the costs of bachelor's degrees have been re-estimated by following the same method we have used in the preceding parts of this paper. The results are summarized in tables 16 and 17. These results resemble the patterns found in tables 5 and table 6. The only exception is the exchanging of positions in the ranking between public doctoral-level institutions and public comprehensive institutions. Even so, the costs for these two are close to each other in all tables.

In addition, the cost of a bachelor's degree has also been estimated by using another allocation variable:

$$\beta' = \frac{\text{BA}}{0.8\ \text{AA} + \text{BA} + 2\ \text{MA} + 3.5\ \text{PHD}} \qquad (12)$$

where AA, BA, MA, and PHD are numbers of associate degrees, bachelor's degrees, master's degrees, and doctoral degrees, respectively.

Table 15. — Regression Coefficients, Means, and Cost Ratios by Type of Institution

Dependent variable: instruction expenditure (in logarithms)

Independent variable	Doctoral	Comprehensive	Baccalaureate
Constant	8.5446	8.2716	6.7795
log (FTEU)	0.5247	0.7612	0.9908
	(12.65)	(32.38)	(41.79)
log (FTEG)	0.5140	0.2278	0.0691
	(14.14)	(12.72)	(6.70)
STUFAC	-0.0074	-0.0009	-0.0003
	(-3.09)	(-1.13)	(-0.40)
AEG	3.73E-05	3.92E-05	0.0001
	(12.11)	(13.28)	(18.06)
Dummy	0.0215	-0.0275	-0.0908
	(0.41)	(-0.75)	(-2.40)
R^2	0.9212	0.8772	0.8953
F	356	566	526.8
number of observations	157	401	313
mean of FTEU	12,409	4,736	1,525
mean of FTEG	3,533	704	88
cost ratio	3.44	2.01	1.21

NOTE.- Figures in parentheses are t-statistics.

Table 16. — Full Institutional Cost of a Bachelor's Degree by Control and Type of Institition: Alternative Cost Ratios, 1983

Type of institution	Average	1st Quartile	Median	3rd Quartile	N[a]	C.V.[b]
All institutions	$25,765	$17,912	$23,326	$30,238	1,271	52
All public	19,370	15,177	18,221	22,107	471	31
Doctoral	17,359	14,383	16,641	19,475	102	24
Comprehensive	18,909	15,134	18,012	21,814	249	29
Baccalaureate	22,034	16,267	20,412	26,746	120	34
All private	29,530	21,586	26,710	34,225	800	51
Doctoral	25,866	17,574	24,174	32,084	56	43
Comprehensive	24,920	17,851	21,469	26,519	153	77
Baccalaureate	31,071	23,549	28,570	35,146	591	44

[a] N: number of observations

[b] C.V.: coefficients of variation (%)

Table 17. — Direct Institutional Cost of a Bachelor's Degree by Control and Type of Institution: Alternative Cost Ratios, 1983

Type of institution	Average	1st Quartile	Median	3rd Quartile	N[a]	C.V.[b]
All institutions	$9,064	$6,683	$8,428	$10,247	1,271	43
All public	8,590	6,972	8,244	9,934	471	27
Doctoral	9,334	7,277	9,145	10,468	102	25
Comprehensive	8,411	6,928	8,027	9,428	249	28
Baccalaureate	8,331	6,861	8,138	9,747	120	27
All private	9,343	6,826	8,481	10,640	800	49
Doctoral	12,604	7,989	11,230	15,395	56	54
Comprehensive	9,171	6,504	7,816	9,764	153	62
Baccalaureate	9,079	6,866	8,496	10,504	591	42

[a] N: number of observations

[b] C.V.: coefficients of variation (%)

The same patterns exist, regardless of the allocation methods, in table 18. The cost estimates of the first two alternatives are close (on the average, the second is about 4 percent higher than the first). The third alternative's estimates, using equation (12), however, is 11 percent smaller than the first ones. The reason for this difference is not clear; it may result from the cost weights assigned to each type of degree and/or the distribution of these degrees.[25]

Table 18. — Institutional Cost of a Bachelor's Degree: Alternative Allocation Methods

Type of institution	Full Cost			Ratio	
	(1) Alternative[1]	(2) Alternative[2]	(3) Alternative[3]	(2)/(1)	(3)/(1)
All institutions	$24,713	$25,765	$22,038	1.04	0.89
All public	18,474	19,370	15,621	1.05	0.85
Doctoral	18,271	17,359	17,891	0.95	0.98
Comprehensive	17,380	18,909	14,761	1.09	0.85
Baccalaureate	20,918	22,034	15,048	1.05	0.72
All private	28,386	29,530	25,861	1.04	0.91
Doctoral	27,996	25,866	22,611	0.92	0.81
Comprehensive	21,689	24,920	17,346	1.15	0.80
Baccalaureate	30,157	31,071	28,313	1.03	0.94

[1] $\beta = FTEU/(FTEU + \delta\ FTEG)$; $\delta = 3$

[2] $\beta = FTEU/(FTEU + \delta\ FTEG)$; $\delta = 1.21$ for baccalaureate; $\delta = 2.01$ for comprehensive and $\delta = 3.44$ for doctoral

[3] $\beta = BA/(0.8\ AA + BA + 2MA + 3.5\ PHD)$ where BA = number of bachelor's degrees; AA = associate degrees; MA = master's degrees; and PHD = doctoral degrees

Alternative Definitions and Adjustments

As pointed out earlier, the cost estimates obtained in the previous parts of this paper are based on certain assumptions and definitions. In other words, with different definitions of a degree, there are different cost estimates. Since the choice of the definitions is discretionary(depending on the purpose of analysis), estimates using different definitions are presented so that the reader will have a sense of how costs differ by the way a bachelor's degree is defined.

In this part, the cost of a bachelor's degree is estimated in five different versions. The current estimates are the first version. The second version is the first version adjusted for dropout credits. That is, in this version, those credits taken by students who eventually drop out are not considered as elements that lead to a degree and are excluded from the calculation. The third version is the same as the second version except that it considers the actual number of credits completed by the graduates, instead of the minimum 120 credits as assumed in versions (1) and (2). The fourth version is a broader definition of the cost of a bachelor's degree. It includes not only the institutional costs but also the opportunity cost, i.e., the foregone earnings that the student gives up to attend college. The fifth version is the broadest definition, which includes not only institutional and opportunity costs but also room and board and other expenses related to the student's college education.

All these versions, except the first one, which has been explained in detail, are discussed in the following subparts. The cost estimates under these five versions are summarized in table 19.

Dropout Credits (Version 2)

Whether the credits taken by students who eventually dropout should be counted in the degree production is debatable. If bachelor's degrees are final products of the educational production process, then dropout credits, which do not lead to a degree, might be considered as "waste" or at least, defective products. These defective products or waste would be identified and sorted out in the cost assessment. Including these products would overestimate the production and hence, underestimate the cost.

The distinction between waste and defective products is important in determining the cost of finished products because the former has no value while the latter may have some. In the theory of the firm, the value of the defective products depends on how these products can be sold. The estimated revenue from these products is considered when a firm assesses the costs of its final products. Though the same techniques may not be applied here, the analogy is worth noting. As shown in table 20, the lifetime incomes for college dropouts (or more precisely, those who have attended 1-3 years of college) are larger than those for high school graduates, though they are, as expected, smaller than those for college graduates. If the value of college degrees is measured by the

Table 19. — Institutional Cost of a Bachelor's Degree: Various Versions

Full Cost

Type of institution	Version 1	Version 2	Version 3	Version 4	Version 5
All institutions	$24,713	$35,084	$37,423	$71,643	$86,227
All public	18,474	29,473	31,438	65,658	79,922
Doctoral	18,271	24,100	27,354	61,574	75,838
Comprehensive	17,380	29,692	27,465	61,685	75,949
Baccalaureate	20,918	39,252	34,000	68,220	82,484
All private	28,386	38,388	40,321	74,541	90,145
Doctoral	27,996	31,356	33,181	67,401	83,005
Comprehensive	21,689	26,032	28,043	62,263	77,867
Baccalaureate	30,157	42,253	42,890	77,110	92,714

Table 20. — Lifetime Income of Men, by Years of School Completed: United States, Selected Years, 1949-1972
(In Current Dollars)

Years of school completed	1949	1956	1961	1964	1968	1972
(1) High school	$175,160	$244,158	$273,614	$311,462	$371,094	$478,873
(2) College, 1-3 years	198,268	278,227	335,100	355,249	424,280	543,435
(3) College, 4 or more years	280,989	372,644	454,732	478,696	607,921	757,923
Difference:						
(2) - (1)	23,108	34,069	61,486	43,787	53,186	64,562
(3) - (1)	105,829	128,486	181,118	167,234	236,827	279,050
Ratio:						
(2)-(1)/(3)-(1)	0.22	0.26	0.34	0.26	0.22	0.23

SOURCES: 1949: Houthakker [1959], table 3.
1956-1972: Cohn [1979], table 3-2.

lifetime income differentials between high school graduates and college graduates, and, similarily, the value of dropout credits is measured by the income differentials between high school graduates and the college dropouts, then the value of the dropout credits is about one-fourth to one-third of the value of a college degree (see last row of table 20).

Whether these dropout credits should be converted to "degree-equivalent" credits based on the above findings is debatable. It is discretionary, depending on what issues are to be addressed. To avoid controversy, version 2 is used in the following discussion, that is, all dropout credits would be excluded because they actually do not make a degree.

The estimates in the previous parts of this paper (version 1), which include dropout credits as "output," are underestimated. They can be viewed as the "minimum requirement" cost of a bachelor's degree because they implicitly assume all credits are the same, i.e., that there is no dropout problem. An analogy with house building can help illustrate this point.

Assume the construction of a house (a degree) requires 120 "building blocks" (120 credits). A contractor purchases 1,500 building blocks at the price of \$10 each and builds 10 houses. Since only 1,200 blocks are required to build 10 houses, 300 blocks are wasted. Supposing that waste is inevitable from the engineering viewpoint, the contractor divides his total bill \$15,000 (\$10 x 1,500) by 10 and sets the cost of each house at \$1,500 -- this is the "actual production cost" per house. How does this approach apply to the cost of a degree? The method used in the preceding parts of this paper (version 1) calculates the cost per block (\$15,000 ÷ 1,500 = \$10) and then multiplies it by 120. In other words, the approach suggests that the cost of the house is \$1,200 (\$10 x 120), that is, the "minimum requirement" cost without considering the inevitable waste. However, if the "waste" credits taken by the dropouts are inevitable, then the "actual" cost of a bachelor's degree should be:

$$D^* = \frac{C}{H - H^*} \cdot 120 \qquad (13)$$

where D* is the "actual cost" of a bachelor's degree; H and H* are the total credits taken by all students and credits taken by the dropouts respectively; C is the total production cost.

That is, the wasted credits, H* are excluded from the total production of credits (H). If the dropouts take as many credits as the other students while they are in school, and the dropout rate is λ, then the wasted credits can be calculated by:

$$H^* = \lambda H \qquad (14)$$

Substituting equation (14) into (13), the result is:

$$D^* = \frac{C}{(1-\lambda)H} \cdot 120$$

Or,
$$D^* = \frac{1}{1-\lambda} \cdot D \qquad (15)$$

where D is the cost of a bachelor's degree without considering the waste credits.

Hence, to adjust for the dropout credits, the cost estimate in the previous version 1 is multiplied by the reciprocal of the "completion rate" (i.e., $1/(1-\lambda)$).

Note: due to the limitation of data, this study assumes that the students take 30 credits a year (see equation (8)), i.e.,

$$H = 30 \cdot FTEU$$

For empirical purposes, the completion rate, $(1-\lambda)$ has been calculated by dividing the number of bachelor's degrees (B) by FTE undergraduate enrollment (FTEU) and then multiplying the quotient by 4, i.e.:

$$COMP = 1-\lambda = \frac{B}{FTEU} \cdot 4$$

Hence,

$$D^* = \frac{C}{(1-\lambda)H} \cdot 120 = \frac{C}{B} \qquad (16)$$

So, with this assumption, the cost estimates adjusted for dropout credits are nothing else but the production cost per bachelor's degree (C/B).

The full costs and direct costs of a bachelor's degree, which are summarized in tables 21 and 22, have been estimated using equation (15). The first column of table 21 is reproduced in table 19 (version 2) for comparison. Comparing the unadjusted estimates (version 1) with the adjusted estimates (version 2), the adjusted costs are about 42% higher than the unadjusted. The gap between the costs for private and public institutions is narrowed because the former, in general, has lower dropout rates.

Number of Credits (Version 3)

Because most students graduate from college with more than 120 credits, the assumption of 120 credits per degree, even after being adjusted for dropout credits, is still not quite realistic. According to unpublished data from longitudinal studies, the average number of credits taken by college graduates is 128.[26] If the actual number of credits taken is

Table 21. — Full Institutional Cost of a Bachelor's Degree by Control and by Type of Institution, Adjusted for Dropout Credits, 1983

Type of institution	Average	1st Quartile	Median	3rd Quartile	N[a]	C.V.[b]
All institutions	$35,084	$22,615	$30,074	$41,067	1,271	69
All public	29,473	20,480	26,146	34,206	471	48
Doctoral	24,100	19,720	22,331	26,862	102	28
Comprehensive	29,692	19,599	25,191	32,444	249	43
Baccalaureate	39,252	26,350	35,747	48,808	120	47
All private	38,388	25,190	33,665	44,960	800	73
Doctoral	31,356	23,299	29,131	37,637	56	45
Comprehensive	26,032	16,720	23,191	28,203	153	72
Baccalaureate	42,253	28,310	36,627	47,243	591	71

[a] N: number of institutions.

[b] C.V.: coefficients of variation (%).

Table 22. — Direct Institutional Cost of a Bachelor's Degree by Control and by Type of Institution, Adjusted for Dropout Credits, 1983

Type of institution	Average	1st Quartile	Median	3rd Quartile	N[a]	C.V.[b]
All institutions	$12,337	$8,605	$10,969	$14,105	1,271	65
All public	12,929	9,611	11,922	14,611	471	42
Doctoral	12,960	10,407	11,996	14,880	102	29
Comprehensive	11,947	8,996	11,033	13,724	249	42
Baccalaureate	14,940	11,132	13,384	17,330	120	45
All private	11,988	7,914	10,207	13,662	800	77
Doctoral	15,288	9,949	13,846	18,392	56	55
Comprehensive	9,664	6,318	8,113	10,464	153	78
Baccalaureate	12,277	8,455	10,509	13,884	591	78

[a] N: number of institutions.
[b] C.V.: coefficients of variation (%).

used, instead of the required 120 credits, then the cost of a bachelor's degree will be a little higher as shown in version 3 in table 19 (the cost will be $37,423, about $2,339 more than that in version 2).

Broader Definition (Versions 4 and 5)

In order to have a better picture of the total cost of a bachelor's degree, the opportunity cost (foregone earnings) and the room and board expenditures per degree have also been estimated. Whether the latter should be included as part of the cost of a bachelor's degree is debatable. In theory, only the additional room and board expenditures that are incurred because of attending college should be counted. However, since the estimation of these additional expenditures is extremely difficult, the whole expenditure is included in version 5. It must be noted that these numbers are exaggerated.

The estimation of foregone earnings includes the following steps: (1) the average weekly earnings for the 16-24 age group in 1983 (i.e., $212) is multiplied by 52 weeks to yield the annual earnings, $11,024;[27] (2) the annual earnings are adjusted for the possibility of unemployment (which was 22.4 percent in 1983), i.e., multiplied by the employment rate (or 1 minus unemployment rate) for the 16 - 19 age group;[28] 3) the annual adjusted earnings or foregone earnings ($8,555) are multiplied by 4 to yield the total foregone earnings, $34,220. These foregone earnings are added to the numbers in version 3 to obtain the costs in version 4. As shown in table 19, adding foregone earnings almost doubles the production cost of bachelor's degrees. This means that the money sacrificed by the students is as large as the direct money invested in their education. The data reveal that the average cost of a bachelor's degree, including opportunity cost, using version 4, is $71,643.

Data on room and board and other related personal expenditures (including transportation, books and supplies, etc.) are taken from Henderson (1986, table 2). The annual expenditures are multiplied by 4 to obtain the following total room and board and related expenses: $14,584 for total public and private combined; $14,264 for public; and $15,604 for private institutions. The amounts are added to the numbers in version 4 to yield the costs in version 5. The average cost of a bachelor's degree, according to this broadest definition is $86,227.

Concluding Remarks

This paper discusses different methods to derive some "ball park" figures for the cost of a bachelor's degree. The scope of this analysis has been seriously limited by the unavailability of data. As a consequence, some assumptions have been made. These assumptions are not beyond dispute. In fact, one can always argue about the rules of allocating indirect costs because there is no perfect way of apportioning these costs to undergraduate instruction. This problem can be addressed by collecting more information on the faculty activities to study how these activities relate to the allocation of the institution's resources. Until the "black box" of the institutional operation is examined, how many resources allocated to a baccalaureate program will be unknown, not to mention the cost-effectiveness of this program, which is the policymaker's major concern. A conceptual framework linking the institution's activities with its financial operation seems to be useful in this case. Indeed, the analysis of cost determination in this study is the first step of this conceptualization.

There are also some other problems which have not been solved in this paper because of the limitation of data and time. The first problem is the assumption of homogeneous credits. As stated in part 1, the cost of a bachelor's degree depends on the student's major. Therefore, given the available data, future research should estimate the costs of bachelor's degrees by discipline. Such studies will require the following data: (1) the distribution (or patterns) of courses taken by students of different majors, and (2) the costs of each course or the expenditures required of the department which offers these courses.

The second problem is the time frame of a degree program. In this study, the cost of a bachelor's degree in 1983 is derived by multiplying the cost per credit hour in that year by 120. That is, the costs for the last year of the degree (1983) are used for all 4 years during which the degree was earned (1980 through 1983). However, this does not give an accurate cost estimate because yearly credit costs change over time. The more accurate and also more time-consuming method is to estimate the yearly credit costs by using 4-year HEGIS data (1980 to 1983).

Another important problem that has not been considered in this paper is that a significant number of students at 4-year institutions are transfer students from 2-year colleges. How does this "transfer" problem affect the cost estimation? Further study of related problems, such as how part-time students and part-time faculty affect costs, would be worthwhile. It would also be useful to derive a time series of estimates for the cost of a bachelor's degree (and also for the cost of an associate degree). Such series would reveal important trends which could be contrasted with other indicators, such as tuition and price indexes.

This study relies heavily on HEGIS data, which are the best available source. However, the data are not perfectly fitted to the purpose of this study because of the following reasons: (1) HEGIS data are basically institutional data; they do not provide much information on the student's expenses; (2) the surveys provide insufficient details on some important cost items such as instruction expenditures by student level and by academic departments; (3) some essential information is also missing, e.g., the number of credits offered in an academic year, the number of full- and part-time instructors, etc.; and (4) despite tremendous efforts, the ambiguities in classifying expenditures by function cannot be totally resolved. The expenditure category on the HEGIS questionnaire has been criticized as not being in the same scheme as the accounting system used by the institutions (the latter looks like a business budget and does not provide the information the questionnaire requests). Hence, the data reported by the institutions do not always reflect the real cost patterns of the institutions.[29] In collecting new data, the Center for Education Statistics may be able to provide better information in the future (e.g., the number of credits will be reported in the new Integrated Postsecondary Education Data System, IPEDS). Coordinated efforts may also be made by State governments or the private sector. Yet, some basic problems of data collection may not be easily overcome because of the decentralized nature of the U.S. educational system.

With the full understanding of all these underlying assumptions and difficulties, it is also recognized that the public has the right to question the operation of higher education, which it supports with millions of dollars. Though straightforward and simple answers are the goal, the public needs to be informed about the assumptions, limitations, and other problems embedded in any "ball park" numbers because these numbers are merely a shorthand presentation of a complicated issue. In other words, the numbers should be interpreted cautiously, considering the content and quality of the degree. Reckless interpretation can lead to disastrous decisions.

GLOSSARY OF ACRONYMS

AEG	Total education and general expenditures per FTE enrollment.
AINS	Instruction expenditures per FTE enrollment.
AJCT	Indirect expenditures per FTE enrollment.
AKCOST	Capital cost per FTE enrollment.
APS	Public expenditures per FTE enrollment.
ARES	Research expenditures per FTE enrollment.
AREV	Total current-funds revenues per FTE enrollment.
ASF	Scholarship and fellowship expenditures per FTE enrollment.
ASS	Student service expenditures per FTE enrollment.
ATUI	Tuition revenue per FTE enrollment.
COMP	Percent of students who completed baccalaureate programs.
FTE	Full-time equivalent enrollment.
PART	Percent of part-time enrollment in total enrollment.
PASD	Percent of associate degrees conferred.
PBSD	Percent of bachelor's degrees conferred.
PFED	Percent of total current funds revenues from Federal government.
PFTEG	Percent of FTE graduate enrollment in total FTE enrollment.
PINS	Percent of instruction expenditures in total education and general expenditures.
PKCOST	Capital cost as a percent of total education and general expenditures.
PJCT	Indirect expenditures as a percent of total education and general expenditures.
PLOC	Percent of total current funds revenues from local government.
PMSD	Percent of master's degrees conferred.
POTHER	Percent of total current funds revenues from tuition, fees, and other sources.

PPHD	Percent of doctoral degrees conferred.
PPRIV	Percent of total current funds revenues from private gifts, grants and contracts, and endowment income.
PPS	Percent of public service expenditures in total education and general expenditures.
PRES	Percent of research expenditures in total education and general expenditures.
PROF	Percent of professors (academic rank) in faculty.
PSF	Percent of scholarship and fellowship expenditures in total education and general expenditures.
PSS	Percent of student service expenditures in total education and general expenditures.
PSTATE	Percent of total current funds revenues from State government.
SAL	Total salary outlay and fringe benefits expenditures per faculty member.
STUFAC	Student-faculty ratio.

NOTES

1. The concept of measuring higher education costs in terms of credit hours is not a new idea. In 1916, the U.S. Bureau of Education presented its data in terms of student clock-hour-units. In 1923, Kelly (1923) also recommended the use of credit hours for decisionmaking. Unfortunately, despite the efforts, the concept of "credit" basis has been ignored by most educational administrators. As a consequence, no data on credit hours have been systematically collected.

2. Using "expenditure per student" as a guideline to evaluate the cost effectiveness of undergraduate programs is the same as assuming all costs are related to a single product. The use of such indicators in a cost-effectiveness study is biased because it ignores the mix between undergraduate and graduate programs as well as the mix between teaching and research.

3. The relationship among these products is even more complicated in the dynamic context. Since yesterday's research results are taught by today's graduate students to tomorrow's undergraduate students, there is clearly a dynamic relationship among the three. Practically, even though they do not share the same costs; they cannot be separated because some of them are inputs of the others.

4. The "peak-load pricing" techniques applied to electric utility load research are basically this type of allocation. See Argonne National Laboratory (1980).

5. Special studies are usually conducted to justify the choice of allocation variable. Once the choice is made, the approach is straightforward. See Mandel (1971). One may also choose more than one variable, such as the case in Wright (1983), which uses linear prediction theory and Bayesian inference to allocate a university's utility cost to research projects based on different types of spaces.

6. For discussion on alternative cost allocation methods, see Kaplan (1977).

7. Whether the credits taken by the dropouts are really "waste" in the production of degrees is debatable. One may argue that the dropout credits contribute to the growth of the economy though they are not counted in the production of college degrees. Those who drop out should have learned some knowledge and skills. Hence, if the focus of the analysis is on issues such as higher education and economic growth, the dropout credits should not be excluded.

8. From here on, the abbreviations of the variable names will be shown in parentheses at their first occurrences.

9. O'Neill (1969) and Skoro and Hryvniak (1980) also included the interest costs for buildings and equipment. This treatment is questionable because buildings and equipment, unlike land, are supposed to be depreciated over time. The estimated depreciation costs represent the usage costs of these assets. On the other hand, there is no depreciation cost for land. For most studies an 8% interest rate was assumed (see Schultz (1960) and OECD (1974, p. 98)).

10. Skoro and Hryvniak (1980) followed O'Neill's (1969) method and compared the results with the "replacement costs" reported in HEGIS. They found the latter is considerably higher than the former by an average of 27.5% for public institutions and 29.8% for private institutions.

11. The assumptions are arbitrary. One may use different assumptions if they have different purposes or evidence. For example, OECD (1974) assumes a 10-year life for equipment instead.

12. These findings were made at least three decades ago. For example, Russell (1958) and Middlebrook, et al. (1955).

13. Some researchers believed O'Neill's assumption that δ was 3, was underestimated. See comments by James (1978, p. 169 footnote 18).

14. This assumption was also used in Halstead (1985, p. 6) and Tierney (1980, p. 459). However, O'Neill (1969, p. 6) downgraded this number to 28 credits because the students could take only 75% of a normal, full load to be classified as full-time students.

15. First-professional students are classified as graduate students in this study.

16. The coefficient of skewness is defined by $E(x-\mu)^3/\sigma^3$ where μ and σ^2 are mean and variance respectively. The coefficient of variation is the ratio of standard deviation to the mean expressed in percentage.

17. This completion rate has many deficiencies. First, it ignores the time lags between enrollment and graduation. Second, not all the undergraduate students are pursuing a bachelor's degree. Third, the quotient is multiplied by 4 because the bachelor's degrees represent only part of the senior class in the last year, which is about one-fourth of the entire enrollment. This computation certainly involves some erroneous assumptions; for example, it ignores the composition of students by instructional levels and the transfer problem.

18. For a review of literature on this subject, see Brinkman (1985a).

19. Hanson (1964) believed that there might be a point of diseconomy of scale in the 20,000- to 50,000-student range, though he said the evidence was inconclusive.

20. Universities which have a large proportion of graduate students may use graduate students to teach undergraduate courses, that is, they substitute the low paid graduate teaching assistants for the high paid professors. If such is the case, then costs for these large universities may be substantially reduced.

21. Significant measurement errors are involved here because the tuitions and fees reported in HEGIS are not separated by level of instruction. The "tuitions and fees per FTE" here are indistinguishable among graduate and undergraduate programs. The same kinds of measurement errors occur in the calculation of "aids/full cost" ratios.

22. If we multiply the right-hand side of equation (6) by FTEU/FTEU, we get: $\beta = 1/(1 + \delta\,(\mathrm{FTEG}/\mathrm{FTEU}))$. We can see the change in δ affects β more if (FTEG/FTEU) is larger. If the institution has very few graduate students, then the changes in δ do not affect the estimate much; in this case, it is close to 1.

23. The cost minimization of a production process with the Cobb - Douglas production function will yield a double-log cost function, see Varian (1974, p. 15-16). In this case, $a_i = {}^{\alpha}i/\Sigma_j d_i$ where $\Sigma_j d_j$ is the production parameter (elasticity) of input x_i in the production function; $\Sigma_j d_j$ measures the return to scale of production.

24. Instruction expenditures are used here instead of total E&G expenditures as the dependent variable. This choice was made because, by using instruction expenditure, the complication of seperating costs of instruction and costs of research and public service could be avoided. Regressions with total E&G expenditures as the dependent variable were tried; however, the results were similar to those in table 15. Nevertheless, the coefficients of the proportion of research and public services expenditures are not significant in these regressions.

25. The correlation coefficient between the first alternative's estimates and the third alternative's estimates is 0.92.

26. I am in debt to Susan Hill of the Center for Education Statistics, (U.S. Department of Education), who provided a preliminary run on the transcript data. According to these preliminary data, the average number of credits taken by college graduates is 128. The data also revealed that, in general, engineering and professional school students graduate with more credits than liberal arts majors.

27. The average weekly earnings for 16- to 24-year-old males (\$223) and females (\$201) were summed up and divided by 2. Data were obtained from the Bureau of the Census, Statistical Abstract of the United States, 1985, table T700.

28. The adjusted earnings can be regarded as the "expected" value of earnings based on the probability distribution of employability. The unemployment data were obtained from the Bureau of Labor Statistics, Monthly Labor Review, January 1985, table 6, p. 71.

29. See Wagner (1983, p. 8) for comments and recommendations on the design of HEGIS. For other suggestions on data collection, see Meeth and Spence (1975).

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Appendix Table

Institutional Cost of a Bachelor's Degree and Selected Variables, by State, 1983

State	N[1]	Full cost	Public %[2]	Doctoral institution %[3]	FTE[4]	PFTEG %[5]
Alabama	26	$21,335	61.5	7.7	3,949	8.9
Alaska	1	42,212	100.0	0.0	2,132	11.2
Arizona	4	18,337	75.0	50.0	16,708	11.7
Arkansas	16	21,489	56.3	6.3	3,220	3.5
California	69	23,962	36.2	14.5	7,022	22.6
Colorado	17	18,710	64.7	23.5	5,646	10.9
Connecticut	16	24,866	25.0	12.5	5,061	14.0
Delaware	3	20,811	66.7	33.3	6,006	14.4
District of Columbia	9	31,448	11.1	55.6	6,494	28.2
Florida	28	20,868	32.1	17.9	5,581	12.9
Georgia	33	22,405	45.4	9.1	3,178	7.4
Hawaii	5	19,527	60.0	20.0	4,478	5.7
Idaho	6	20,900	66.7	16.7	4,112	7.1
Illinois	52	28,318	21.2	15.4	4,446	11.7
Indiana	39	24,958	30.8	10.3	4,281	6.2
Iowa	29	27,708	10.3	6.9	3,039	4.2
Kansas	23	24,274	30.4	8.7	3,319	7.3
Kentucky	20	25,490	40.0	10.0	4,253	6.1
Louisiana	21	19,555	16.9	9.5	6,128	9.5
Maine	11	32,542	45.5	0.0	2,135	5.5
Maryland	23	28,432	52.2	8.7	3,917	12.0
Massachusetts	46	27,209	23.9	15.2	4,505	11.0
Michigan	37	27,195	40.5	10.8	6,056	7.9
Minnesota	27	23,837	37.0	3.7	4,815	4.6
Mississippi	15	22,514	53.3	20.0	3,501	7.8
Missouri	34	24,120	32.4	11.8	3,700	8.3
Montana	7	20,471	57.1	14.3	3,624	6.0
Nebraska	14	22,507	42.9	7.1	3,832	6.2
Nevada	2	17,565	100.0	0.0	7,585	11.0
New Hampshire	10	24,976	30.0	10.0	2,793	8.1
New Jersey	22	21,387	50.0	13.6	5,650	11.7
New Mexico	9	20,471	66.7	22.2	4,391	8.7
New York	96	29,767	24.0	16.7	4,332	10.7
North Carolina	44	24,840	34.1	9.1	3,462	5.7
North Dakota	8	23,957	75.0	12.5	3,027	2.8

Appendix Table

Institutional Cost of a Bachelor's Degree and Selected Variables, by State, 1983—Continued

State	N[1]	Full cost	Public %[2]	Doctoral institution %[3]	FTE[4]	PFTEG %[5]
Ohio	50	25,053	24.0	20.0	5,449	9.3
Oklahoma	21	19,028	57.1	9.5	4,303	10.6
Oregon	15	25,871	33.3	13.3	3,750	12.5
Pennsylvania	85	26,883	25.9	8.2	3.505	5.9
Rhode Island	7	25,259	28.6	28.6	4,632	8.4
South Carolina	26	25,488	42.3	3.9	2,634	4.0
South Dakota	11	22,790	45.5	9.1	2,001	3.3
Tennessee	35	25,263	25.7	8.6	3,344	4.1
Texas	63	20,774	47.6	14.3	5,576	14.2
Utah	7	18,989	57.1	42.9	9,672	6.4
Vermont	13	29,893	30.8	7.7	1,561	8.9
Virginia	38	24,946	39.5	7.9	3,762	6.5
Washington	16	25,206	37.5	12.5	5,720	13.0
West Virginia	17	21,137	58.8	5.9	3,130	3.2
Wisconsin	30	24,449	43.3	10.0	5,050	4.8
Wyoming	1	24,947	100.0	100.0	9,243	13.9
Guam	1	21,920	100.0	0.0	1,943	4.9
Puerto Rico	12	12,695	25.0	0.0	5,832	2.0
Virgin Islands	1	22,070	100.0	0.0	1,556	5.0

[1] Number of institutions.

[2] Percent of public institutions in total number of institutions.

[3] Percent of doctoral-level institutions in total number of institutions.

[4] Full-time-equivalent enrollment.

[5] Percent of full-time-equivalent graduate enrollment in total full-time-equivalent enrollment.

Comments

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Our response to Duc-Le To's paper, "Estimating the Cost of a Bachelor's Degree: An Institutional Cost Analysis," has four parts. We begin with a short critique of the philosophy and basic assumptions upon which the paper was developed. Various technical issues are dealt with in the subsequent sections: the selection and treatment of expenditures, the procedures used to explain costs, and the procedures used to calculate costs on a per-degree basis.

Concern About Costs

The paper opens with an assertion that the public has become more aware and concerned about the costs of higher education. This is probably the case. The assertion is then made that the public cares about the cost of a degree. It does, but not in the sense intended.

As a rule, people care about costs that they must bear or for which they are somehow responsible. Institutional administrators worry about their annual budgets in which costs (measured as expenditures) must be kept below revenues. State officials in the legislative and executive branches are concerned about balancing the State budget and about the distribution of expenditures among State sponsored services, one of which is higher education. These officials focus their attention on the total amount of money going to higher education. They are also interested in providing an "adequate" amount of resources to their public colleges and universities, within the context of the missions those institutions have. Because of this second interest, State officials do scrutinize costs per student or per credit hour, often comparing such figures among their own institutions or with institutions in other States. In our experience, they do not examine costs per degree nor have they expressed interest in such data. At the Federal level, the primary concern is the cost of student aid. That concern is directed toward the bottom line, which is an aggregate figure that is related most directly to annual costs per student rather than costs per degree.

To the extent that anyone worries about the cost of a degree, it is likely to be students and their parents. Their concern, however, is directed toward the cost of the degree to them, i.e., its net price, and not the cost of producing a degree, the issue addressed in this paper. This is typical, is it not? An individual buying a Buick concentrates on getting a good buy from the dealer, not on what it costs General Motors to build the car. Students and their parents are consumers of higher education, and they think accordingly.

A cost analysis is likely to be meaningful when it is directed toward a decision, when there are alternative resource allocation strategies to compare, and when the locus of costs, i.e., "whose costs", is kept clearly in mind. Given those conditions and what we have said about the lack of immediate concern about the costs of producing a bachelor's degree, is there justification for attempting to learn what those costs are? We think so, for the reasons that follow.

Two separate streams of analysis come together in the cost-per-degree calculations developed in this paper. First, there are calculations of costs per FTE student (or per student credit hour). Second, there are considerations of numbers of degrees granted, considerations that incorporate attrition issues. Both streams have merit in their own right. The calculation of cost per degree represents a mechanism for pulling the threads together into a single statistic that, when interpreted over time, holds promise for considerable utility.

We conclude that the appropriate purpose for developing data on the cost of a college degree is to create an indicator (or set of indicators) that is designed to be background information, i.e., information designed to undergird decisionmaking in a general rather than a specific way. To put it differently, even though the calculation of per-degree costs may not be meeting an immediate need, these cost figures may have utility in the longer term if the figures are treated as indicators. This means that, among other things, the cost figures are to be viewed as summary statistics that would be generated year after year, juxtaposed to other movements in the economy, such as general price inflation, and to other developments in higher education, such as changes in the mix of degrees produced. One way of utilizing these statistics would be to identify instances in which investigation into underlying phenomena would be warranted.

In this context, it is important to note that this paper deals at some length with those underlying phenomena. Broadly speaking, there are two kinds of cost analysis. The purpose of the one is to determine what the costs are. The purpose of the other is to determine or explain why the costs are what they are. This paper contains both types of analysis. We would argue, that while the first type of analysis in this instance yields background information, the second type yields insights (to the extent that the analysis is done properly) that are of immediate interest to all concerned. The costs of college are always of concern. The rise in costs during this decade, as reflected in the prices charged by the institutions, is creating even more interest--but it is a "why?" issue more than a "what?" issue. In that it attempts to explain observed cost behavior, Duc-Le To's paper is timely.

Cost Calculations

Our comments in this section are directed to the procedures used in the paper to calculate costs. The procedures utilized can perhaps best be characterized as reflecting an accounting approach in that the focus is on expenditures as they are recorded in institutional ledgers (after crosswalking to the HEGIS reporting format). Such an approach is appropriate given the circumstances. Updates of the data used will be available annually. Both direct and full (direct plus indirect plus capital) costs are determined. A sensitivity analysis is included, an important step given that several arbitrary (although informed) cost allocation decisions had to be made. In short, we find little fault in the overall approach to calculating costs.

Calculation of Direct Costs. In higher education institutions, expenditures are recorded both by object of expenditures and by function. In HEGIS, the national reporting system, expenditures are reported only by functional category. As calculated in the paper, direct costs include expenditures for instruction, student services and scholarships and fellowships. We have no problem conceptually with the instruction and student services categories, but there is a data problem. Expenditures for instruction in the HEGIS reporting system include expenditures for departmental research. In general, the amount of effort going into departmental research is related to institutional type. Expectations and accommodations (e.g., lower teaching loads) for departmental research are, not surprisingly, relatively substantial at research universities and quite modest at colleges whose principle mission is teaching. This difference means that straightforward comparisons of instructional costs between different institutional types, including the comparisons included in this paper, cannot be taken at face value. It also means that time-series data on instructional costs, such as the data shown in table 2,page 5, are somewhat ambiguous because one cannot necessarily assume that the proportion of "instructional" expenditures being used for departmental research has been constant. Indeed, there is evidence to suggest that this proportion has changed (James, 1978).

A further note on table 2. The data shown in this table are said to represent the distribution of education and general (E&G) expenditures. The reader is likely to interpret this as meaning that the percentages are based on total E&G expenditures, when in fact the percentages shown are based on total current fund expenditures.* The former is the better distribution because the latter involves expenditures for auxiliary enterprises, university hospitals, and independent operations of various kinds, none of which has anything to do with education *per se*. The percent of E&G expenditures going to instruction has declined, to be sure, but a figure of 41.5 percent (instruction/E&G) for instructional expenditures in 1980 is a better portrayal of the underlying situation than the 31.5 percent (instruction/current fund expenditures) figure shown in the table.

We have a fundamental problem with including scholarships and fellowships (S&F) as part of production costs. As a data element in HEGIS, S&F creates conceptual difficulties because it contains both institutional monies and pass-through monies such as Pell Grants, neither of which has anything to do with production costs. S&F affects the price students pay for their education, not the cost of production.

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* In response to this comment, table 2 has been changed to show the correct percentages of education and general expenditures.--Duc-Le To.

The way the model in this paper works, however, the more the price to students is reduced, the higher the cost of production. In reality, if there is a relationship at all, institutional aid probably serves to hold down production costs because it reduces the amount of operating revenues available to spend on the factors of production. Governmental aid is just a pass-through: if the government sent the checks directly to the students, the money would not show up as an expenditure in this model. Other aid awards that go directly to students, e.g., awards from a community service organization, are ignored (quite rightly) in this model. We argue that Federal student aid should likewise be omitted from the institutional production cost calculations.

Another major problem in including student aid is the changes that occur over time in the definition of the S&F category in HEGIS. When the treatment of Pell Grant monies changed in 1983-84, from being recorded in the agency fund (essentially a fund for pass-through monies) to being recorded as part of S&F expenditures, the total national cost of producing a bachelor's degree went up by roughly $2 billion according to the model in this paper. In reality, of course, this was simply an accounting change having nothing whatever to do with an increase in the cost of production. This problem needs to be corrected before doing any trend analysis that relates 1983-84 costs to costs in prior years.

Calculation of Full Costs. Apart from our misgivings regarding the elements included in direct costs, we have no major difficulties with the elements included in full costs. It is appropriate to include academic support, institutional support, operation and maintenance of plant, and "other," as components of indirect costs. It is a minor issue, but we can find nothing but mandatory transfers that would fit the category of "other," so it would make more sense to us to label the fourth element of indirect costs with its actual, and more informative, name.

We also have no conceptual problem with including depreciation charges on the replacement value of buildings and equipment as part of capital costs (a better name would be capital use costs), but the 20-year depreciation period for equipment seems too long. Ten years seems more reasonable.

Conceptually, there is an additional capital related cost that is not recognized in the model, and that is implicit rent, i.e., the revenues given up by using the buildings for educational rather than for some other purpose. Such costs are included, for example, in cost studies by Schultz (1960) and by Brinkman and Leslie (1983). The total cost involved can be several billions of dollars for all institutions. Nonetheless, implicit rent is not always included in capital use charges in higher education, especially when the cost analysis is designed to determine accounting costs rather than economic costs (for example, see Arthur Young Company, 1986), the estimation procedure leaves something to be desired, and the underlying data are relatively soft. Thus, we are not lodging a strong protest on this matter, just noting that, at least with respect to implicit rent, the cost estimates are conservative.

Two types of data problems arise in the calculation of the full costs of production. The first is the general data "softness" that haunts most costs studies using national data, but that may not be serious for the purposes of this model. For example, the replacement values of buildings and equipment as reported in HEGIS are only estimates. The comparability of these estimates is not likely to be high.

Other data problems are more serious. These are omissions in the data that could systematically undermine the comparison between the public and private sectors. The root of the problem is the treatment in various States of such fundamental cost elements as employee benefits. A State may pay directly for certain of the costs incurred by its public institutions, while private institutions pay all of these same types of costs themselves. In using HEGIS, with its unit of analysis being the institution, one has to hope that institutional staff who fill out the survey will take the trouble to include a pro rata share of State expenditures. Problematic areas include the following (there may be others): States will sometimes fund some personnel costs, such as retirement programs, out of a central State personnel system; less often, States may pick up the cost of some utilities; and debt on buildings and capital equipment may be handled at the State level, or the State may simply purchase higher education buildings outright, resulting in an artificially low level of debt service at the public institutions when compared to private institutions that have no choice but to borrow to acquire their buildings or major capital equipment. In each instance the errors go to the same direction, namely, they lower the costs for the public sector. It is critical that this be kept in mind when comparing costs between the two sectors.

There are also allocation issues to discuss. We have already noted what we like and dislike about the most important allocation decision, that of deciding which expenditure areas (functions) to include in the calculation of direct and full costs. Another allocation decision is that required to disentangle undergraduate from graduate-level educational costs. A multiplier is used to transform graduate student counts into undergraduate counts so that the proper proportion of costs related to graduate students can be removed. This multiplier is reasonable for full costs, although, as is eventually done in the paper, it is better to recognize that the multiplier differs somewhat by institutional type. To make the multiplier a function of institutional type, it might be better to use estimates based on allocational studies, as synthesized in Brinkman (1985), rather than the estimates derived from the regression analysis currently utilized in the paper. The differences among the estimates are quite modest, however, so the results of the analysis (shown on page 39) would probably not be appreciably different.

In calculating direct costs, it would make better sense to adjust only instructional costs with a graduate/undergraduate cost ratio. In other words, it seems to us that it costs no more to provide student services to the typical graduate student than to the typical undergraduate student.

Reasons for Cost Variation

A dual approach is taken in the paper to explain the behavior of calculated costs. First, the author disaggregates the results by institutional type and provides the reader with a variety of data on institutional characteristics, as a means of suggesting factors that might explain higher or lower costs. Second, the author uses regression equations designed to explain the variations in cost among institutions. Both of these conventional approaches to explaining costs are reasonable.

The wide range of institutional descriptors provided in the paper is useful. There may be utility in a further disaggregation by institutional type. Data presentation problems quickly increase when additional breakouts are done, but it happens that the institutional classifications used, although appropriate for the study generally, are quite broad. They could be concealing much that is of interest with respect to the reasons for the observed cost behavior.

The regression analysis had the potential to provide some of the most interesting data in the paper, but it was disappointing in some important respects. The most critical missing piece for both regressions, the one attempting to explain differences in full costs per bachelor's degree (page 28) and the one attempting to explain differences in total instructional costs (page 36), is a conceptual framework. In fairness, the portion of the paper immediately preceding the first regression does show institutional characteristics that seem to be correlated with full costs per degree. So it is not as though the author is starting completely from scratch. The fact that institutional characteristics are correlated, however, does not mean they have causal relationships or that the causal relationships run in a particular direction. Yet this is precisely what one must either know, or at least have a theory about, if one is to construct a regression model in accord with generally accepted standards. A "fishing expedition" using stepwise regression is no substitute for building a model based on theoretical expectations.

In the absence of a theoretical framework and the constraints it imposes, all sorts of variables are likely to find their way into a regression model. Consider the equation on page 28. Although it is referred to as a cost function, it surely is not that, at least not in the economist's sense of the term. For example, a true cost function controls for the prices of the inputs used in the production process whenever there is reason to believe that producers may be paying different prices. The equation shown does include average faculty salaries, which is an appropriate way to control for an important input price in higher education. However, the equation also contains the prices charged by the institution, in the form of average tuition. From the standpoint of the meaning of "cost function," that variable does not belong in the equation. Furthermore, its presence in the equation in all likelihood means that all of the estimated coefficients are biased. The independent variables should have a one-way causal relationship with the dependent variable, as the names suggest, or the estimated coefficients are subject to simultaneous equations bias. For the equation in question to be properly constructed, one would have to believe that higher tuition leads to higher cost, but that higher cost does not lead to higher tuition. Only the most die-hard advocate of the so-called "revenue theory of cost" would accept this version of the world.

To give another example, the same equation also contains the student-faculty ratio as an independent variable. This certainly changes how one understands the economy-of-scale question addressed by the model. It is one thing to ask whether average costs decrease as the number of students in an institution increases when the institution is free to deploy its resources to take advantage of increased size. It is another thing to ask that same question when the student-faculty ratio is being held constant. We would not be surprised if the correlation at public institutions between the number of students and the student-faculty ratio were quite high, perhaps high enough to be the reason why the coefficient on the ratio was not statistically significant. Including a correlation table in the paper would have allowed us to examine this possibility and other relationships of interest. The fact that the ratio used is the number of full-time-equivalent (FTE) students divided by the number of full-time faculty (rather than FTE faculty) makes interpretation even more difficult.

The second regression equation is cleaner, but it too raises questions. For example, How does one interpret an equation which is an attempt to determine the impact of graduate enrollment on instructional costs but controls for (i.e., holds constant) the student-faculty ratio? Is it not reasonable to assume that one of the important factors that makes graduate education more costly than undergraduate education is the need to use a lower student-faculty ratio at the graduate level? This variable is included in the model with no theoretical underpinnings, making interpretation difficult at best. The same can be said for another variable, average educational and general expenditures, which one would normally not expect to see as an independent variable in a cost function, the essence of which is to explain costs in terms of output. In our judgment, both models answer quite different questions than are being asked in the text of the paper.

Calculating the Cost of a Degree

The approach taken in the paper will be considered first and then an alternative. The institutional expenditures that are to be used as the numerator in the calculation have been discussed above. The denominator for the cost per degree calculation is developed as follows. HEGIS provides data on numbers of FTE students. With an assumption or two about the meaning of full-time equivalency, an estimate of the number of credit hours earned at an institution in a year can readily be derived, as it is a simple multiple of the number of FTE students. With total costs (direct or full) and total credit hours in hand, the cost per credit hour for the year is derived by simple division. Then cost per degree is derived by multiplying cost per credit hour by 120, the assumed minimum number of semester credits required to earn a bachelor's degree.

Several aspects of this approach are problematic. First, there are some data issues. The underlying data on the number of FTE students is not beyond challenge. There are differences among institutions in the way that these data are reported to HEGIS. It is not obvious, however, that this will be anything more than noise in the system, as it does not appear that there are systematic differences by type of institution. Another matter related to the student count is that enrollment typically is lower during the second half of the academic year. Since the HEGIS enrollment figure is a fall census count, the figure leads to an underestimate of unit costs. The dollars, which are spent over the entire year, appear to be spread over more students (and, thus, credit hours) than are actually enrolled for the full year. This is probably not a serious problem either in terms of the magnitude of its effect.

There are conceptual problems as well, and they are of greater concern. First, although the author argued at the outset of the paper that the public needed to know more than the cost per student, one has to wonder whether the cost per degree as calculated in the paper actually provides much more, given the underlying arithmetic relationships between these two cost figures. Second, the model treats all credit hours as if they cost the same aross programs, when in reality they do not. This results in an average cost-per-degree figure that conceals a great deal. Third, the fact that costs change from one year to the next is also ignored, as if all 120 credits were earned in the same year. To be fair, the author explicitly recognizes these problems. But recognition aside, they still diminish the validity and utility of the results of the model.

The author's initial estimates of degree costs ignore the problem of student dropouts, or, in model terms, of credits earned that do not contribute to degree production. Later in the paper, a procedure is adopted for taking these credits into account. We are uneasy about this procedure. It uses a simple ratio of first-year students to degree winners in order to estimate the dropout effect. That ratio is just plain messy in that it reflects, but does not reveal, the comings and goings of many students and the effects of various unique situations. For example, there are public universities that can award more bachelor's degrees in a year than they have first-year students. Negative attrition? No, just large influxes of students in the junior year (from 2 -year colleges). This phenomenon will lead to an underestimate of costs in the model, because these universities will not be penalized for credits earned by dropouts. We are not sure how big a problem this is for national level data, but we are sure that State level data thus constructed would be seriously misleading. If it is fair to assume that public institutions are more likely than private institutions to experience large additions to enrollment in the junior year, then public-private comparisons are also jeopardized.

We also have problems with the discussion in the paper of the dropout issue. On page 7, the proposition is put forward that only half of the students who start college with the intention of getting a degree actually graduate. This is highly questionable. Other sources estimate that 65 percent of those who enter 4-year colleges eventually graduate. Determining the correct figure is no small task. It would be better to finesse the issue by simply saying that a substantial number of credits are earned by students who never obtain a degree.

The term "waste" which is used to refer to dropout credits is unfortunate and unnecessary. It presumes that the bachelor's degree is the only final product for all individuals who enroll. This is simply untrue (as the annual CIRP data show). For many students, higher education is a consumption not an investment good. Most administrators and faculty in the institutions do not consider credits earned a waste just because the student did not graduate. For those who believe that learning has some inherent value, no credits are a waste insofar as they represent learning. This is not to say that given the task to determine the cost of a degree one ought not to account for dropouts, but only that the language and the rationale should be chosen more carefully.

The cost-per-degree calculated in this paper is a constructed figure in that it is based on assumptions about the number of credit hours earned by students in obtaining a degree. As an alternative, one could divide the total costs (direct or full) allocated to undergraduate education by the actual number of bachelor's degrees awarded. Total expenditures over 4 years could be divided by the total number of degrees over 4 years. The total expenditure figure could be divided by some number that is greater than zero but less than one as a way of reflecting the dropout effect. This approach would eliminate the need for a few assumptions and would adjust for changes in cost over time; however, it deals with the dropout effect in the same way as the current version and thus leaves a serious problem.

Conclusion

Despite all the problems, we think there is value in pursuing the task of finding an acceptable way to calculate cost-per-degree as an indicator. More thought needs to be given to the comparability problems between institutional types (the departmental research issue), the various comparability problems between public and private institutions, and the dropout issue. Given that adjustments and improvements are possible, we would suggest juxtaposing the cost-per-degree indicator to a cost-per-student indicator. Monitored over time, the two summary statistics together could yield interesting and informative data about the higher education enterprise.

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Comments

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The paper, "Estimating the Cost of a Bachelor's Degree: An Institutional Cost Analysis" by Duc-Le To, is a thorough, thoughtful attempt to review, develop, and contrast estimates of the costs of a bachelor's degree. The paper provokes comments because assumptions and data limitations are immediately acknowledged. As result, the paper provides a useful starting point for further discussion of how the cost of a bachelor's degree might best be estimated.

My comments touch on what I believe to be the most important questions raised by this paper. Each one warrants further discussion both to help interpret the generated figures and to assist in the development of possibly better measures of costs. The three questions are:

In concept, which of a wide array of possible measures of costs will best fit the paper's intended purposes and audiences?

Are the data adequate to the task and the definitions and assumptions appropriate and defensible?

How should we interpret the estimates?

Which Measure of Costs Should be Used?

While the purpose of the paper is to develop a single measure of the costs of "producing" a bachelor's degree, it is not clear what this single measure should be. On page 1 we read that the public needs a straightforward answer to its questions (about costs).[1] But, at no point are we told exactly what questions the public wants answered (and, presumably, what questions the cost measures developed in this paper are trying to answer).

The clearest statement of intent, on page 50, seems to imply that the cost measure is to be used in a broader, general appraisal of cost-effectiveness (or cost-benefit or cost-utility):

> ". . . recognized that the public has the right to question the operation of higher education, which it supports with millions of dollars . . . "

This interpretation of intent finds support in recent statements by Secretary of Education William Bennett (e.g., at the Catholic University conference). But, even if the single measure is to be used in a broad assessment of cost-effectiveness, the most appropriate measure of costs can only be developed if the question of interest is clarified further.

Given what appears to be the paper's stated concern with the "public's" stake in higher education, the emphasis on institutional costs appears to be most open to dispute. As the author correctly notes on page 9, estimates of institutional costs do not adequately address the question of what a bachelor's degree costs the "public." A more appropriate assessment of the costs to "society" might sum the value in alternative uses of all resources devoted to the delivery and acquisition of the set of bachelor's degree-level competencies, skills, and attitudes.[2] Under this view, resources extend beyond institution-provided services (instructors, facilities, library) to include student-provided services (study time).[3] A measure of the public's costs, so defined, is provided in the paper as version 4 in table 19.

The implications of employing this broader measure of costs--the costs to "society"--are not inconsequential. If one were concerned with how the costs of a bachelor's degree had changed over time, it may well be that the rapid growth in direct costs noted by Secretary Bennett could have occurred while the "public's" costs grew modestly. This would be true if colleges and universities altered programs in ways that allowed students to economize on study time (i.e., spend less time out of the labor force). What is the evidence? The increase in the absolute and relative numbers of part-time students (who, according to Census data, are almost twice as likely to be employed as full-time students) and the accumulating evidence that students are working in greater relative numbers than anytime in the past 15 years implies that indirect costs have risen more slowly than otherwise might have been the case (see e.g., Wagner 1984; Doran, Wagner, and White 1985; Minnesota Higher Education Coordinating Board 1985). Have colleges and universities incurred relatively greater costs in an effort to accommodate part-time students and students who work? Here, in spite of assertions by institutional representatives, the evidence is not so clear (see, e.g., Brinkman 1985). Nonetheless, if the question is framed in this way, the institutional cost analysis is, at best, incomplete (and, at worst, misleading).

This point raises a second general question. Accepting that there is some value to knowing the college's costs of "producing" a bachelor's degree, how precise an estimate do we require? If the intent is to develop a "reasonable" set of cost estimates--say, something comparable to the student budget figures assembled and released every year by the College Scholarship Service--then a series of crude cost figures, sensitively developed and averaged, would probably be satisfactory. Under this approach, one is less concerned with sources of differences in the amounts spent to provide instruction. Rather, the more important questions concern how the cost measures are obtained and interpreted.[4]

Are the Data Adequate and the Definitions Appropriate?

In moving from concept to measurement, the author has clearly acknowledged rather severe data limitations and measurement issues. In my judgment, the data limitations can be (and have been) addressed in reasonable ways. The measurement issues are not so easily dismissed.

The paper draws principally on finance data obtained in the Center for Statistics' Higher Education General Information Surveys (HEGIS). These are collected from institutions according to rather specific instructions. While the terms and categories used in the survey ensure a reasonably consistent reporting of expenditures by function, they do not elicit finance information in a form sufficient to fully develop appropriate measures of the costs of a bachelor's degree. Among the data limitations, three stand out.

First, the data apply to a single year rather than to an "average" student's program of study. Ideally, what one requires is the course-taking behavior of a cohort of entering students as they move through higher education (see, e.g., Hopkins and Massey 1981). The costs associated with these patterns would be accumulated and averaged across the relevant base (to include or exclude dropouts, as appropriate). Such data, even up to some level of aggregation, are simply not available beyond one-time transcript studies or the computerized data bases at selected institutions. Lacking this data, the author estimates bachelor's degree costs by multiplying an average per credit hour cost by the 120 (or 128) credits assumed for the standard degree program. What is not known is the extent to which this approach introduces sizable errors in the calculation of a "true" average cost measure.

Second, some expenditures are simply not collected. According to Ryland (1981), HEGIS fails to obtain a full accounting of outlays for central administration, State education departments or commissions, State loan or grant agencies (administration), and social security or pension costs for State college employees paid through a separate State agency. The omitted outlays add perhaps 2 to 3 percent to education and general expenditures. Although not large, the amounts disproportionately support programs and operations at public institutions.

Third, the HEGIS data do not generate sufficiently detailed reports of direct expenditures for undergraduate instruction (as opposed to graduate instruction), of indirect expenditures for undergraduate instruction (as distinguished from graduate instruction, research, and public service), or of the market value of buildings and equipment. Admittedly, these details are often difficult to ascertain at an institution (see, e.g., Wagner 1983). But, without some additional information, the author must employ a series of assumptions to develop the required estimates. Here, we have a bit more on which to reflect: the rules used to measure and allocate instruction and indirect costs can be challenged.

1. Should scholarships and fellowships be treated as a "cost" item? The paper includes them as a component of the direct costs of instruction. Such an approach may be justified if institutions consider scholarships and fellowships as the means to "acquire" resources--students of a particular type--which contribute to the provision of instruction (see, e.g., Wagner 1985). An alternate view, holding that these outlays reflect not so much costs as discounts on gross tuition paid, would seem equally defensible.

Would the alternate assumption greatly affect the cost estimates? From table 9, scholarships and fellowships account for about 9 percent of total education and general expenditures at low-cost institutions compared to a 17 percent share at high-cost institutions.[5] Based on this comparison alone, costs not only would be lower but some of the variation across institutions would fall as well.

2. Should all "irrelevant" costs be excluded from instruction (p. 9)? For example, a teaching hospital or a university dairy farm might be operated as an auxiliary enterprise with very close ties to instruction. Student unions may be operated by students. To assert that these linkages exist in no way suggests how to deal with them (as the author has correctly noted).

3. How should "indirect" costs be allocated? Lacking information from institutions on negotiated rates or missions, the author chooses to allocate a fixed amount of all "indirect" costs among operating functional areas. One alternative that appears more plausible is to allocate costs of indirect activities according to the functional areas they serve. For example, academic support services might more appropriately be allocated to research and instruction; libraries to research and instruction; institutional support to research, instruction, and public service.

   This alternative (along with the allocation rule used in the paper) is arbitrary. To divide indirect costs among instruction, research, and service requires us to make some assumptions about how colleges and universities weight these activities. A second alternative would drop the "flow of benefits" approach entirely. To take an extreme position, one might argue that institutions of higher education view themselves first as institutions delivering instruction. Research and public service, then, might be treated as "additional" activities which impose incremental direct and very modest additional indirect costs (see, e.g., Bowen 1980).[6] But, the bulk of indirect costs would, in this view, be appropriately assigned to instruction--even to undergraduate instruction. Under this assumption, some of the differences in average costs across institutional segments would narrow.

The Level of and Variation in Average Costs: A Matter of Interpretation

The foregoing really raises the question of how these cost measures should be interpreted. First, the figures display a great deal of variation--even within segments comprised of roughly similar institutions. Part of the answer is, of course, that the breakdowns do not adequately pick up all sources of potential cost differences: institutions deliver bachelor's degree-level instruction in different ways (professors, graduate students, adjuncts); provide different mixes of joint or related "products" of graduate education, research, and public service; offer different mixes in the composition of enrollments across fields (e.g., high-cost technical programs vs. low- cost humanities programs); enroll varying proportions of students with different social, economic, and academic backgrounds; confront different constraints in the ease with which resources can be (or are) shifted in the short term (e.g., tenure arrangements, physical plant); operate at different scales; face different supply functions for goods and services; respond to differing oversight requirements (e.g., State regulation and/or approval of expenditures); or manage and administer programs in different (in some cases, less efficient) ways.

From his own very detailed study of costs, Howard Bowen concludes that even further disaggregation among institutions and programs would not fully account for differences in observed costs. He observes:

> Even if one could select tiny groups of comparable institutions so homogeneous as to eliminate all cost differences, one would not change the reality that the cost of carrying out essentially the same services varies widely among American colleges and universities. The dispersion of costs is astonishingly great--so great that one may reasonably question the rationality or equity in the allocation of resources among institutions of higher education (p. 24)

These observations give rise to Bowen's "revenue theory of costs." Simply, institutions spend what they get. For the purposes of this investigation, Bowen's view suggests that the measures generated in the paper reflect not only the amounts of factor inputs legitimately required to "produce" a bachelor's degree but also the resources (revenues) available to purchase them. The paper takes up this issue on page 25 and in table 9.

Concluding Observations

Taken together, these comments prompt several recommendations:

First, some careful thought should be given to the purposes to which the cost estimates will be put. At the extreme, the emphasis on institutional costs may be inappropriate. With respect to the development of institutional cost estimates alone, assumptions and measurements may differ depending upon the specific question to be addressed.

Second, the figures as developed must be interpreted very cautiously--as little more than an indication of the relative "order of magnitude" of the amounts spent on a bachelor's degree. Cost estimates by institution segment should not be emphasized, largely because the assumptions underlying the allocations of direct instruction costs and all indirect costs lead to differences which may narrow considerably (or disappear entirely) if alternate assumptions were employed. Combined with the very tenuous relationship between expenditures and outcomes, the comparisons create the false impression that high cost per student is necessarily inefficient (or relatively low cost per student is efficient).

Third, if the Center for Education Statistics wished to undertake further investigations in this area, several avenues appear ripe for study. These might include: (1) the development of cost estimates based on the course-taking behavior of a cohort of students (tracking those who transfer); (2) the development of cost estimates based on profiles of faculty time allocation; (3) the development of cost estimates based on alternate estimates of the allocation of indirect costs (the latter coming from interviews with institutional representatives and reviews of specified "overhead" rate arrangements with external funders).

None of these observations or recommendations would lead to the development of a cost estimate without flaws or subject to challenge. They would, however, help to advance our understanding of the resources allocated toward undergraduate instruction.

Notes

1. Although it is not clear from the discussion, the "public" is taken here to mean everyone (not just the taxpayers who provide support for higher education through public subsidies).

2. This general formulation ignores the possibility of different mixes in the competencies, skills, and attitudes acquired in different programs or institutions. But, see note 4, below.

3. The use of the student time imposes opportunity costs, typically valued at prevailing market prices for alternate uses of the time (e.g., wage rates or salaries).

4. Among others, two clarifications are required. First, are we concerned with average or marginal costs? Not all questions call for measures of average costs. The public might be interested in how changes in the level and/or composition of enrollments affect costs. State policymakers and institutional officials do approach decisions in this way and, therefore, make use of measures of marginal, rather than average, costs. The use of average cost measures may be justified if one is interested in assessing efficiency or trends in costs for an entire system, institution, program, or student type. But, again, some of these concerns may be posed in ways that imply changes: What does it cost to "produce" 15 percent more bachelor's degrees (or how much would be saved if 15 percent fewer bachelor's degrees are "produced")?

   Second, are costs to be evaluated over the short or long run? Whether intended or not, the analysis can best be interpreted as an appraisal of long run costs (employing, as it does, panel data).

5. It is not clear whether Pell grants have been included in the scholarship and fellowship amounts. Whether or not they are to be included, several additional questions must be addressed. First, other current expenditure categories include sources of student support which provide an implicit subsidy. For example, college work-study aid, a part of which is pure subsidy, is included in expenditures for the units where students are employed. For consistency, the subsidy component should be subtracted from the current category and added to scholarships and fellowships. Second, an unknown portion of scholarship and fellowship support covers expenses other than the costs of instruction. If student aid is considered as a source of "discounts," a subtraction of aid supporting student living costs would reduce the size of the offset against instruction expenditures.

6. O'Neill's allocations of 5 and 15 percent of indirect costs to extension and organized research, respectively, appear no more arbitrary than the one used in the paper.

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Comments

by Robert Zemsky, Professor and Director
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Some of my most enduring memories from graduate school I owe to a seminar presided over by a cantankerous old man who could, with a mere twitch of an unkempt eyebrow, reduce even the most articulate graduate student to mumbling ineptitude. The nominal subject of the seminar was methods of analysis. What we were being taught, however, were standards that would enable use to know good scholarship when we encountered it--and more importantly, to recognize drivel without having to spend too much time contemplating it. Such lessons were driven home in a series of bristling commentaries on our field's well regarded and not so well regarded scholarly works.

One day he appeared in a state of what he liked to call "high dither." A new book had just been sent to him for review and he was ready to render his judgment. "Ladies and gentlemen," he began, "this work is about a critical subject the author at best understands imperfectly. He has produced a book that should not have been written; and once written should not have been submitted for publication; and once submitted should never have been published; and now that it is published our only choice is to bur . . . well, not quite. It is, after all, a work about an important topic that tells us much about what not to do."
Duc-Le To's paper, I am afraid, teaches much the same lesson. He too has tackled a critical issue: the seemingly inexorable rise in the cost of a college education. Everywhere one turns, there are new complaints that the operating costs of colleges and universities are spiraling out of control. As an industry, higher education is being told that it has become fat and wasteful. With insufficient incentives to become more efficient, colleges and universities spend the meager productivity gains they make on quality enhancements--enabling teachers to teach less and pursue academic specialities of little value except to themselves.

It is with this context in mind that Duc-Le To's paper should be read. The issue is not, as he suggests in his opening, a matter of filling an obvious hole in the research literature. Nor is it a matter of providing intelligible as well as intelligent analysis to a lay public concerned with the rapidly escalating price of higher education. The truth of the matter is that the officials for whom Duc-Le To works have already made up their minds. Last fall the Secretary of Education made clear that he meant to do something about how and why colleges and universities have so much money to spend. In October 1986, for example, about the same time Duc-Le To was completing a version of his essay, the Secretary lectured the Nation's best endowed university on subordinating means to ends--and not incidentally, on higher education's preoccupation with money. Bennett's Harvard speech was calculated to excite. On the editorial page in my local paper in Lancaster, Pennsylvania readers were treated to Andrew Mollison's syndicated column which ran under the headline: "BENNETT INSULTS HIGHER EDUCATION TO OPEN COSTS' DEBATE," and the columnist's conclusion that it was the Secretary's "new crusade--cost containment for colleges and universities" (Lancaster Sunday News, October 12, 1986, p. A-7).

The Assistant Secretary most responsible for Duc-Le To's paper, Chester Finn, if anything has a reputation of longerstanding for questioning higher education's finances. In 1978 his Scholars, Dollars, and Bureaucrats observed, in language that would not be widely adopted until a decade later, that "though student aid is most often discussed in the high minded language of equal educational opportunity, from the viewpoint of institutions whose well-being depends on having enough students it plays a more utilitarian role, not very different from the discounts, rebates, and bargain days encoutered in the commerical world." Federal aid, moreover, was being awarded with little sense of the real benefits such programs bestow in relation to their costs:

> If the government does not endeavor to provide steak to its food stamp recipients, or a lavish standard of living for its social security beneficiaries, why should it assist a needy eighteen-year-old to enroll at Harvard or Sarah Lawrence, particularly when quite satisfactory educational institutions are available at markedly lower prices? (p. 59)

The answer Finn proposed in 1978 was to create a two-tiered program of federal student aid which would have reimbursed students for costs based, not on what the institution they attended charged, but largely on the average costs for all colleges and universities. The system would be two-tiered because it would be necessary to calculate a "public" average cost and a "private" average cost. Finn's proposal prevented a student from pocketing the cash if he chose an institution with lower than average costs; it also prevented him from "increas[ing] his federal entitlement by selecting a more expensive college within either the public or private sector, meaning that the added cost of enrolling at a higher-than-average-priced institution would translate into a dollar-for-dollar increase in his self-help requirement" (Finn, pp. 96-98).

My sense, then, is that Duc-Le To's paper is not so much a contribution to the research literature as the "next step" in a calculated public campaign to reduce the costs of higher education. I have no quarrel with the goal nor necessarily with the tactics with which this campaign is being waged. I too sense a new determination on the part of those who pay higher education's bills to make colleges and universities implement the same cost cutting programs imposed upon corporations, hospitals, and local and State governments over the last decade. I understand that higher education, as an industry, does not know how to become more efficient or convert productivity gains into savings. Colleges and universities do not know-- indeed have largely chosen not to find out --what it costs to produce their educational products. I can even accept the rationale of Federal officials, exasperated with the industry's inability to come to terms with its own spiraling prices, of deciding first that colleges and universities are too expensive and then searching for a calculus that will help them and the institutions whose costs they seek to control spend less money on the education of undergraduates. The question is, does Duc-Le To's paper provide that calculus?

The answer, frankly, is no! Like many others who commented on the early drafts of the paper, I am impressed with his industry, his willingness to confront often hostile critics, and his determination to complete the assignment given him. The paper has been substantially improved, and yet its fundamental flaws remain, thus eroding the credibility of its calculation of the average cost of a bachelor's degree for six different classes of 4-year institutions.

The basic problem is that the paper builds on assumptions that carry it at each turn further away from establishing a base line for the costs of a bachelor's degree. Duc-Le To begins his analysis saying that neither he nor the public will be "satisfied with the simple cost computation such as 'expenditure per student'" (page 1). What he produces, however, is just that. The analysis builds on the assumption that on average a bachelor's degree consists of 120 credits or an average of 30 credits for each of 4 years. Accordingly, Duc-Le To multiplies each institution's HEGIS report of its full-time-equivalent enrollment (FTE) by 30 to calculate what he labels "total undergraduate credits" for a given year. This result becomes the denominator in an equation which, because it has "costs" as its numerator, is labeled "cost per credit." This result is then multiplied by 120 to yield an institution's "production cost of a bachelor's degree" (page 13).

Given the constants with which each institution's FTE students are transformed into total credits, what in fact we have is cost, or if you like, expenditure per full-time-equivalent student per year. When this figure is multiplied by four, the result is not the cost of a bachelor's degree, but rather the average expenditure per student per year times four. The only way this figure could approximate the average cost of 4 years of college--which is still not the "production cost of a bachelor's degree"--is if within the institution everyone who enters graduates so that there are nearly the same number of freshmen, sophomores, juniors, and seniors, no part-time students and no nondegree candidates. Alternatively, Duc-Le To must assume that the retention rate, persistence to graduate rate, and proportion of part-time and nondegree students is constant within each of his six classes of institutions. Neither assumption works.

He faces the same problems with his "costs" numerator. Again he begins in the right place, seeking the proper disaggregation of the costs of undergraduate instruction from the costs associated with graduate instruction and research supervision. For convenience, however, he assumes that, on the average, graduate/research related instruction is three times as expensive as undergraduate instruction in all classes of institutions. It is an assumption that simply will not fly--it is both counter intuitive and at variance with a number of case studies. In an appendix, Duc-Le To does present a limited sensitivity analysis which, while conceding that the ratio of graduate instructional cost to undergraduate instructional cost varies by institutional type, argues that these variances make little difference to the overall result. He reaches this conclusion, however, by treating the ratio in question as a constant within a class of institutions rather than allowing it to vary by individual institution. Again, in order to simplify his analytic procedures, he necessarily simplifies our understanding of how education works and the high degree of institutional variability that characterizes higher education in this country--an institutional variability which, among other causes, derives from the importance some of the Nation's most expensive institutions have placed on educational excellence.

Two addditional assumptions reveal either a curious naivete about the functioning of private institutions or an out-in-out bias against the private sector. In Duc-Le To's calculation of direct costs he includes financial aid expense and then is surprised to note how much more expensive private institutions are than public institutions. Common practice, as well as common sense, long ago recognized institutional funded financial aid for what it is: a form of selective price discount, or more simply a revenue reduction. If the issue is which sector of higher education is more efficient--and it seems to me that is precisely the issue as framed by the Secretary and Assistant Secretary--then financial aid expense has no business in the calculation. Financial aid is not part of the production function, at least not as we have come to understand that term when applied to higher education. All of Duc-Le To's calculations are rendered useless for purpose of meaningful policy debate by the inclusion of financial aid expense in what he calls direct costs.

He compounds this error by including the value of the physical plant in his calculation of full costs. Never mind that most people familiar with HEGIS data and how institutions fill out the requisite forms understand the unreliability of these particular items. The fact that public facilities used by public institutions of higher education are often built and maintained by a State authority or agency means that such expenses are not reported by the institution on the appropriate HEGIS schedule. As a result, the cost of public instruction is understated.

To sum up my technical concerns with Duc-Le To's paper: he is analyzing the average cost per credit hour, not the average cost of a bachelor's degree; he makes a numbing series of assumptions which, while simplifying his analytic task, go against our basic understanding of how higher education functions; he seriously distorts the cost differential between public and private institutions by including financial aid expense as a cost of instruction and by failing to account for those public facilities used by public institutions but not included in their HEGIS reports.

When I ask myself what would I have had Duc-Le To do instead, another voice from my graduate school days echoes back. No matter what the question, the diplomatic historian Samuel Flagg Bemis had a single answer: multi-archival research. What he taught his students was that the answer never lay in a single source or even a multitude of sources collected in a single place. To get the right answer you had to go out and compare the evidence stored in a wide variety of places. Duc-Le To should have done the same thing. He examined HEGIS data because it was there--available, catalogued, ready to be processed by the Department's computers. But there are other sources beside HEGIS.

For use in their funding formulas, for example, a large number of States keep detailed data on the costs associated with credit hour production. The advantage of these data is that they ordinarily reflect the costs of specific disciplines or programs at both the beginning and advanced levels. Taking these data and the institution's stated requirements for a bachelor's degree, Duc-Le To could have calculated the instructional cost for a series of bachelor's degrees. What he would find no doubt was that the costs varied dramatically by discipline, in part because some disciplines are inherently more expensive than others, physics, for example, but also because for some disciplines there are simply not enough students to justify the costs. Indeed, my suspicion is that the real cause of higher education's spiraling costs is not inefficiency but rather over capacity. Put simply, physics is not only inherently expensive, but most large universities have enough capacity to educate three or four times as many undergraduate physics majors as they do. It is not a trivial question. We would do the Nation's colleges and universities substantial damage if we were to conclude from analyses like Duc-Le To's that these institutions could be made more efficient in terms of reducing unit costs when in fact the problem is not unit costs but excess capacity.

As a minimum, would not it have been reasonable for Duc-Le To to test some of his conclusions using these more disaggregated data, just to see if his findings were substantiated? True, there are not similar data for private institutions, but we might have had a little more confidence in his methodology if we could be shown it was a reasonable substitute for more detailed analysis for at least a significant segment of the higher education industry.

I can anticipate the Assistant Secretary's gentle chiding: "There you go again, making something simple into something complex, and in the process denying us a result that will help get a handle on higher education's spiraling costs." My answer is that complexity is often the norm. To pretend otherwise leads to results that, although they are presented as being based on data, are for the most part a set of calculations without much meaning.

Rejoinder

by Duc-Le To

The reviewers are in part correct when they indicate that there are problems with the paper. Zemsky and Wagner point out that it has data limitations and, sometimes, arbitrary assumptions have been made. Wagner comments that the estimates in the paper do not adequately address the question of what a bachelor's degree costs because some noninstitutional costs are not included. Furthermore, he states, they are also not adequate for addressing the efficiency issues because the quality of the bachelor's degrees is not considered. (Hence, high cost does not imply inefficiency .) Zemsky is also correct in stating that HEGIS data may be inadequate for the study. As he points out, "the answers never lie in a single source or even a multitude of sources collected in a single place." Notwithstanding these limitations, the paper addresses and sheds new light on some rather important questions in education finance which, I believe, are seldom addressed and deserve more attention than they receive.

A few misinterpretations of the approach taken appear to exist and should, first, be identified and clarified. First, it seems to me that Zemsky misunderstood the adjustments of dropout credits in the paper. He said, "(the study) assume(s) that the retention rate, persistence to graduate rate, and proportion of part-time and nondegree students are constant within each of (the) six classes of institutions." The comment is incorrect. These assumptions were not made; nor were they implied by my calculations. As stated clearly in the paper, the completion rate (or 1 minus dropout rate) was calculated by dividing the number of bachelor's degrees by FTE undergraduate enrollment and multiplying the quotient by 4 for each institution. In other words, the estimated completion rate is different for each individual institution. It is not constant within a class. I also did not assume a constant proportion of part-time and nondegree students. As one may recall, I did not use "head-count" enrollment data in my paper. All enrollment data used are in terms of full-time equivalents (FTE), in which part-time enrollment is converted to full-time by the individual institution. Thus, the proportion of part-time students is not constant as Zemsky charged. There is no special treatment for nondegree enrollment in this paper. However, no matter how this enrollment is treated in the institutionally reported FTE enrollment data, I did not assume a constant proportion of nondegree students.

Zemsky also commented that the assumption of a constant cost ratio of graduate instruction to undergraduate instruction, within a class of institutions, prevented the understanding of how education works and the high degree of institutional variability which characterizes the higher education system. This is not a fair statement. I would like to remind the readers here that assuming a constant cost ratio (δ) is not the same as assuming a constant allocation parameter (β) (see equation (6)). In other words, while assuming a constant cost ratio (δ) within a class of institution, I did not use a constant allocation parameter (β) to allocate indirect costs. The allocation parameter, β, is different for each institution. Hence, institutional variability is not totally ignored in this case.

Brinkman and Jones commented on the regression analysis in the paper. Some of these comments appear to be misinterpretations. As stated earlier in the paper, the purpose of the first regression (table 11) is to show the relationships between costs of bachelor's degrees and the influencing factors. Although it relates cost to quantity (i.e., FTE), it is not, nor was it intended to be, a function of output and input prices. As indicated, the variables, "tuition revenue per FTE student (ATUI)" and "student-faculty ratio (STUFAC)," were included to reflect the "affluence" and "structure" (or in some sense, production technique) of the institution. The former variable (ATUI), intended to measure the affluence of the institution, was used to test Bowen's hypothesis that institutional affluence is a major factor in resource allocation. (See Bowen (1980), Chapter 7). Hence, it should not be interpreted as a "price."

The purpose of the second regression (table 15) was to obtain an estimate of the cost ratio of graduate instruction to undergraduate instruction (i.e., the parameter, δ). The rationale of this regression has been discussed in part 4 and note 23.

While noting that the development of a complete cost model of higher education is beyond the scope of this study, I share the feelings with the critics that a model of cost behavior of higher education institutions is useful for more accurate and detailed analysis. Nevertheless, as I have stressed in the paper, the regressions can be considered the first step of a more ambitious attempt.

There are also disagreements with the treatment of student financial aid in the cost estimation. I agree that scholarship and fellowship expenditures are items that need to have more careful consideration if precise estimation is desired. However, I do not agree that these expenditures have nothing to do with the cost of a bachelor's degree. As we know, the expenditures include both institutional monies and monies passed through the institution by governments or outside organizations. The former is discretionary. That is, the institution can spend its own funds according to its strategies but these monies also have opportunity costs (i.e., they must be taken from some other expenditures in the institution's budget). From this viewpoint, institutional scholarships and fellowships, like other institutional expenditures, are monies allocated under deliberate institutional planning and, therefore, should be considered as operating costs.

The relationship between the pass-through monies and the cost of bachelor's degrees is not as clear as the institutional monies, but I do not agree that they have no connection at all. Although these monies cannot be used at the discretion of the institution, they help the institution attract enough students to maintain a certain operations scale. If economies of scale exist (as shown in table 10), then the additional students attracted by student financial aid would help to lower unit cost. In fact, it is doubtful that the production cost of a bachelor's degree would be the same if such monies had not been spent.

Brinkman and Jones indicate that an individual buying a Buick may concentrate only on the price, not on what it costs General Motors to build the car. This is true but the example does not apply to higher education. The individual who buys a Buick does not invest in General Motors. But the individual (or the family) who pays to attend a college invests in higher education as a taxpayer and/or a donor. In other words, as both an "investor," and "consumer," the individual will wonder how much money is required to provide the education he or she wants and how the money (investment) is actually used. However, he or she will not know the answer unless the costs of providing these educational services are revealed.

This perspective is like that of the commodities market, e.g., the corn industry. There are a lot of reasons that the price of corn may go up: increase in labor cost, increase in the demand of corn, poor weather, poor management, reduction of government subsidies, etc. However, it is not known whether the price increase is "demand-pulled" (due to increase in demand) or "cost-pushed" (due to increase in cost) until the cost of corn is revealed and its changes are contrasted with the changes in its price. With regard to the cost factor, which this paper focuses upon, one must collect cost data and ask whether aggregate statistics, such as the cost of running a farm, explain these changes or whether there is a need to find some way to parcel out the cost of corn alone in dealing with the above problems. I believe research in higher education finance would be more useful if it followed the same patterns as the analysis of the cost of corn, i.e., cost disaggregation. Of course, this type of study has limitations.

As I mentioned at the beginning, the estimation techniques and the available data used in this paper are not perfect. Technical difficulties were expected. The study, if it did nothing else, called attention both to the importance of the issues and the problems that exist in developing an acceptable answer. Some of these problems (e.g, cost disaggregation, resource allocation, etc.) are unavoidable in explaining complex phenomena in higher education finance, such as the increase in tuition or the price of higher education. Zemsky, however, does not seem to recognize this. It is hard to understand why he suggests that this study should not be attempted while admitting that colleges and universities do not know or do not choose to find out what it costs to produce their educational products. My question is: Should research be done to find an answer to a problem or at least to find the way to solve a problem, once the problem is identified? I hope we all agree that the answer is yes. I was surprised that this paper was interpreted as providing conclusive answers to policymakers. It was, indeed, only intended to stimulate discussion and research on the subject, and to some degree, that goal appears to have been achieved.

AFTERWORD

If I may be permitted the liberty of adding a few paragraphs to this publication, I'd like to thank Duc-Le To for persevering with the preparation and revision of his most interesting, informative, and provocative original contribution to the scholarship of higher education; to convey my personal appreciation to Emerson Elliott, Sally Kilgore, and Ed Darrell for directing the complex processes by which this publication came into existence; to recognize the many outside experts and advisors (named in the acknowledgments) for their help during key phases of the project; and to thank the authors of the three commentaries, published here along with Duc-Le To's paper, for helping the reader to understand both the value and the limitations of the analyses presented herein.

When the Office of Educational Research and Improvement supports a piece of research or analysis, the views expressed in the text of a report, article, monograph, or whatever other form the product appears in are the author's. We may suggest editorial changes but the author is free to eschew them. At the same time, we in OERI remain free to make such public comment on the author's work as we see fit, indeed we have an obligation to do so if we judge that the author's words are apt to mislead or misinform the reader.

This, we believe, establishes a healthy and mature relationship between a government agency, the private citizens, and the non-Federal organizations whose work we support. No one "censors" anyone's conclusions or interferes with their public appearance. Yet everyone remains free to comment on the work of other parties to this relationship.

That said, let me respond to Mr. Zemsky's allegation that this entire project was designed as "the 'next step' in a calculated public compaign to reduce the costs of higher education," a campaign being waged--Zemsky asserts--by Secretary Bennett and myself.

This is a bit like accusing the weather bureau of conspiring to inundate the land with snow or charging the Census Bureau with fostering pro- (or anti-) natal policies via its reports on population trends.

The Office of Educational Research and Improvement bears the primary responsibility within the Federal government--and with its predecessors has borne this responsibility for 120 years--for informing the American people about the "condition and progress of education" (to recall the phrase Congress used in 1867). Our stock in trade is information, preferably timely and accurate information, of use to millions of people across the land who make decisions about education -- people ranging from individual families seeking to understand how they might help their youngsters do better in school, to governors, legislators, and congressmen who shape the policies of vast education systems and programs.

With limited resources, we constantly have to choose the kinds of information we can produce that would be of greatest utility to the Nation. We have to use our judgment, but we are not guessing wildly.

One such judgment that I made about a year ago was that the Nation needed an accurate estimate of the average cost of a college degree, something I was surprised and dismayed to learn was not already available. It seemed to me--and still seems to me--that a college degree is a major investment, and it is reasonable for those making the investment (parents, schools, States) to be able to find out how much one costs.

It seemed useful to set forth an estimated cost precisely because the cost of a college degree is seldom if ever equal to the price charged for such a degree and because the cost is usually borne by many different public and private sources, not just by the individual receiving the degree.

As readers will already have noted, the undertaking didn't turn out to be as simple as that! We have done nothing more than initiate a line of inquiry and analysis that will require time, subtlety, sophistication, and better data to pursue a more broadly satisfactory result.

Does Mr. Zemsky really think we should not even have tried, should not have begun the inquiry? "Ignorance Is Strength" may have been a satisfactory motto for the Ministry of Truth in Orwell's 1984 but in OERI in 1987 we are more interested in knowledge. The knowledge, of course, could be more perfect (and the suggestions made by Zemsky and his fellow commentators will help it to become perfect in the future) but one must start somewhere.

Will such information help those who, as a matter of conviction or policy, believe that the costs of higher education should be reduced or should not rise as fast as they have been? Perhaps so. Zemsky himself has "no quarrel with this goal," conceding that "colleges and universities do not know--indeed, have largely chosen not to find out--what it costs to produce their educational products."

Do I believe that American higher education is none too efficient and not nearly as good as it ought to be, considering the resources it consumes? Indeed I do, and, as Mr. Zemsky observes, I have thought so for some time. If a careful reading of this publication, complete with all the caveats about its analytic limitations, encourages others to move toward similar conclusions, I will not weep.

But let's be clear that this would have been a vastly different document had its main purposes been political or polemical. Not the least of those differences is that we wouldn't have incorporated the comments of outside reviewers such as Mr. Zemsky--and, if we had, more than one in four would have said something about nefarious motives. Messrs. Brinkman, Jones, and Wagner are distinguished independent analysts--and outstanding critics.

All of their technical criticisms, caveats, and suggestions are welcome. This publication is meant to be a first word, not the final word, on a complicated and important matter.

But the proof of this pudding is in the eating. And we look forward to hearing from other readers.

Chester E. Finn, Jr.
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Counselor to the Secretary